

HACHMEISTER

The Occurrence & Distribution
Of Nitrates and Nitrites in
Food, Feces and Urine

Chemistry

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THE OCCURRENCE AND DISTRIBUTION OF
NITRATES AND NITRITES IN FOOD,
FECES AND URINE

BY

HENRY WILLIAM HACHMEISTER

B. S. University of Illinois, 1906

THESIS

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Henry William Hackmeister.

ENTITLED *The Occurrence and Distribution of
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BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF *Master of Science*

H. S. Grindley.

In Charge of Major Work

Wm. A. Noyes.

Head of Department

Recommendation concurred in:

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THE OCCURRENCE AND DISTRIBUTION OF NITRATES AND NITRITES IN FOODS, FECES, AND URINE.

INTRODUCTION.

In connection with the nutrition investigation, made by the Laboratory of Physiological Chemistry, Department of Animal Husbandry, on the Effect of Potassium Nitrate on Metabolism, a careful study was made of the occurrence and distribution of nitrates and nitrites in foods, feces, and urine. The object of this special study was, first, to thoroughly and completely review and compile, the present information as to the occurrence of nitrates and nitrites in foods, feces, and urine, and secondly, and primarily, to study in detail the occurrence and distribution of nitrates and nitrites in the foods, feces and urine of the twenty-four members of the "Nutrition Club" covering a period of eight months.

HISTORICAL.

The presence of nitrites and nitrates in soils, water, and plants has been known for a long time, as has been the presence of nitrates in human urine, and while much has been written on the subject, the experimental work along this line has not been very extensive. As one of the objects of this research was to make a complete and exhaustive review of the literature on the subject of nitrates and nitrites, the following plan of study was followed. The four most important recent contributions on the

subject of nitrates were selected, namely, those of Richardson (66) Snyder (67), King and Whitson (23), and Rohmann (45). These articles were read and abstracted, and a complete bibliography was made of the articles referred to, each reference being put on a separate card. These articles were in turn read and abstracted and all references indexed as before. This method was adhered to throughout, new articles being added when found and treated in a similar manner.

By this system, we get back to the time when chemical analysis depended upon some physical property and results were purely arbitrary. We find in 1775 for example, that is, at the time when the manufacture of gunpowder and the refining of saltpeter was taken up by the French government, that the method in use could hardly be called a chemical one. The saltpeter to be tested was placed in an iron spoon, heated to redness, and the relative amounts of salt and saltpeter present were arrived at from the intensity of the deflagration. That results obtained in this way were unsatisfactory is apparent.

In 1728, Guyton de Morveau suggested a method for the analysis of the crude saltpeter that depended upon the insolubility of potassium nitrate in an alcohol solution of lead nitrate. This suggestion was at once taken up by the Paris refinery, where the tests were made under the supervision of Lavoisier, but it was soon found that the results of the tests were not correct, for they did not agree with the yield obtained in the refinery. Berzelius, Geoffroy, and Dufault suggested modifications of the method by substituting other salts for the lead nitrate, and, although, these suggestions were followed, the accuracy of the results was not

improved, for they were still low.

The complaints and petitions of the producers of the crude saltpeter finally caused the government to call to the Academy for assistance. The Academy appointed a commission, consisting of the foremost chemists of the day, among whom were Beaume, Vater, Berthollet, Taurcrocy, and Vauquelin, to investigate a new method of Riffault's, depending on the insolubility of potassium nitrate in a saturate solution of potassium nitrate. The commission decided that the method was satisfactory, and recommended that it be used, and although the National Assemble issued a decree that the approved method of Riffaults was to be the official one, it was not until 1797 that the same was put to use in the refinery. It soon became evident that this method gave high results, which was found to be due to the insolubility of potassium chloride in the saturated solution of potassium nitrate, but nevertheless it was still in use in 1847 for the want of a better one.

In 1847 Pelouze (42), made use of the reaction between ferrous chloride and hydrochloric acid in the presence of nitric acid or the salts of nitric acid. These substances when heated together react with the formation of nitric oxide and an oxidation of the ferrous chloride to ferric chloride. This method marks the real beginning of chemical methods for the determination of nitric acid, and a short description of the Pelouze mode of procedure is of interest. Pelouze made up a solution of potassium per-manganate and determined its factor by means of piano wire dissolved in hydrochloric acid in the absence of air. He then placed a weighed amount of this iron wire in a flask, added hydrochloric acid, and boiled the acid until the wire was in solution, keeping out

the air. He ~~the~~ then added the saltpeter solution to be tested, boiled the mixture until nitric ceased coming off, and determined the amount of potassium nitrate in the sample from the quantity of ferrous chloride oxidised to ferric chloride, which he found by titrating the residue in the flask with the standard potassium per-manganate solution.

In 1835 Schloesing (48), wishing to determine the nitric acid content of tobacco, made use of the principle of the Pelouze method, which he had to modify as organic matter interfered in the original method. Instead of determining the amount of nitric acid from the oxidation of the ferrous chloride, Schloesing collected the nitric oxide, given off, over mercury, washed the collected gas with milk of lime to remove carbon dioxide, and after oxidizing the nitric oxide to nitric acid by means of oxygen gas, determined the the nitric acid by titrating with succrate of lime. After assuring himself that the method was really reliable by determining known amounts of potassium nitrate, he turned his attention to the effect of organic matter on the efficiency of the method. Urea, amygdalin, gluten, asparagin, sugar, and castor oil, were among the substances used, and it was found that though some of the organic compounds slightly effected the accuracy of the results, the addition of more iron removed this disturbing influence almost entirely. Schloesing then analysed a large number of tobaccos, and found that the leaf, with the main rib removed, contained from .02 to 2.00 per cent of nitric acid, while the main rib contained from .14 to 2.00 per cent. Schloesing concludes by stating that his method is applicable for the analysis of plant extracts, soils and ⁱⁿ⁻organic salts, and

that organic matter does not cause material error.

In 1860 Fresenius (10) reviewed the methods in use at the time and, after testing the methods of Braun, Schloesing, and Ville, came to the conclusion that the method of Schloesing was the only one of value, and the technic of the method once mastered was not so difficult as it appeared.

Schoenbein in 1834 (50), was the first to discover the presence of nitrates in human urine, and although his work was but qualitative, ~~he~~ being unable to make use of the Schloesing method, he is still quoted in modern investigation, and some of his discoveries have never been overthrown. Schoenbein noticed that in no case were nitrites present in fresh urine, while all samples examined contained appreciable amounts of nitrates. He also found that nitrites are present in urine that has undergone decomposition, and that the morning sample decomposes more rapidly than one voided later in the day. After investigating the nitric acid content of water, vegetable foods, and beer, Schoenbein concludes that the presence of nitrates in urine is due to the nitrates in the ingested food, and it is of interest that every investigator since that time has held the same opinion, in most cases even quoting Schoenbein's exact words, to wit, "all well, river, and sea water, as well as many of our plant foods as cabbage, spinach, etc., ^{contain nitrates,} so that the origin of the nitrates in urine is easily explained. It does not follow, however, that all the nitrates eliminated in the urine come from this source, for it is possible, though improbable, that a small amount of these salts are formed in the organism."

In 1870 Schulze (52) modified the procedure of Schloesing in that he determined the quantity of nitric acid from the volume of nitric oxide given off during the reduction of the nitric acid, by means of the ferrous chloride and hydrochloric acid. Schloesing had not deemed this method practical, as he feared that other gases, besides carbon dioxide might be given off during the operation that could not be easily absorbed. Schulze, testing his method by means of known amounts of potassium nitrates in pure water and in the presence of organic matter, found it to be just as accurate, and much more convenient^{en} than the original method of Schloesing. Together with Schultz, Schulze determined the nitric acid content of seventeen varieties of beets, finding up to .385 per cent of saltpeter in the beet root.

The development of the beet sugar industry at this time caused a great deal of activity along the lines of the chemistry of the sugar beet. Not only were the chemists interested in the sugar content of the various beets, but the nitrogenous compounds both protein and nonprotein, were investigated. Accordingly we find that a number of these investigators, Zoller (24), Sutton and Alvens (56), Schrodt (54), Wulfert (65), Ulrich (24), and Schrober (24), give data on the saltpeter content of the various kinds of beets. The values vary from .004 to .385 in the fresh substance, and are given as high as 7.69 per cent in the dry substance.

In 1875 Tizmann (58) reviewed the work of Schulze and Wulfert, and after modifying their method by substituting boiled sodium hydroxide solution for the mercury, and a flask, provided with a two holed rubber stopper through which he passed the delivery

and the pungent taste, for the reason of Schloesing, found that the method was accurate and that organic matter did not interfere. No data is given.

Frusling and Grover (13), becoming interested in the nonprotein nitrogen compounds of plant foods, by the work of their contemporaries on the sugar beet, studied the saltpeter content of grasses, pulses, and seeds, and found that ripe seeds did not contain nitrates in appreciable amounts, but that green pulses and green grasses contained up to .10 per cent.

In 1880 Rohmann (45) following up the observations of Schoenbein, and some made by himself in a previous investigation (46), gave a valuable and comprehensive contribution on the elimination of nitrites and nitrates in urine. His work is without doubt the most thorough investigation on nitrate metabolism to date, and perhaps the only real investigation on this subject. Rohmann investigated the relation between ingested and excreted nitrates, using dogs and rabbits as subjects, also the source of the nitrites in decomposed urine, and in the saliva and perspiration. In his metabolism work Rohmann fed the subjects on nitrate free diet consisting of milk, bread, and fresh meat, these foods having been found nitrate free by analysis. His conclusions are of value and are as follows: Nitrates are found in fresh urine, while nitrites are not. The quantity of nitrites in decomposed urine is never greater than the corresponding value for nitric oxide in fresh urine, the nitrites being formed by the reductive decomposition of the nitrates and not by the oxidation of ammonia. That nitrates in the urine are caused by the presence of nitrates in the ingested food and are not formed in the organism, this being

found true in dogs, rabbits, also the urine of suckling infants was found free of nitrates. That but a part of the injected nitrates are excreted in the urine, a part being eliminated from the body as perspiration and some being secreted by the salivary glands, and some probably reduced to ammonia, also that the method of Schloessing as modified by Schulze is adapted to the analysis of urine, milk, bread, meat and other foods.

The work of King and Whitson (23), and that of Snyder (67), has but little bearing on this work, except in so much as they mention the nitrate content of a few foods. King and Whitson found that green oats, corn and potatoes grown on nitrated soil gave higher results with the modified Kjeldahl method for the determination of total nitrogen in the presence of nitrates, gave higher results than with the ordinary method for total nitrogen, and calculated this difference as nitrates. Snyder found the same to be true of wheat grown on soils fertilized with sodium nitrate. Both King and Whitson and Snyder were interested in the effect of fertilizers on the produce, and their finding of nitrates was but incidental to their work.

Richardson's work (66) is of importance to this subject as he determined the saltpetre content of a large number of vegetable foods, beets, spinach, egg-plant, lettuce, radishes, celery, tomatoes, cabbage and others, besides bread, meat, cereals, and a number of fruits, among which were pears, apples, grapes, and watermelons. The complete summary of the results of Richardson's investigation are as follows:--

(1). Nitrates are of general occurrence in plants in all stages of growth, and particuⁱlarly in the early stages.

(2). In the mature parts of plants, such as ripe seeds and fruits, only small quantities of nitrates are found.

(3). In some cases, notable quantities of nitrates remain in the mature plant, as in ripe beets and turnips.

(4). The amounts of nitrates found in plants are of the same order but rather more in many instances than those found in cured meat.

(5). A person on a diet consisting wholly or largely of fresh vegetables would consume more nitrates than one on a mixed diet consisting in part of cured meat.

(6). As much as the equivalent of from one to two grams of saltpeter daily could be consumed by a person eating fresh vegetables.

(7). In so much as fresh vegetable diet is entirely harmless, as no case of injury from saltpeter in cured meat is on record, saltpeter in quantities used in cured meat must be classed as a harmless preserv^vative.

Richardson also finds nitrates in milk in three out of the four samples he examined, but as he is the only investigator that has been able to locate the same in fresh milk except as the result of adulteration, and as Richardson does not mention the source of the milk analysed, his results^{are} of little value in this connection.

In closing the review of the literature on the subject of nitrates, it might be well to briefly mention some of the less important investigations on this subject. Blyth (1) mentions that the presence of nitrates in milk and wine are due to adulteration with water, but that pepper contains various amounts, giving the results of the analysis of a number of peppers. Weyl and Citron (6) found that the amount of nitrates in urine is the smallest with a

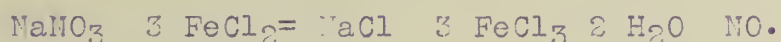
meat diet and largest with a vegetable diet, and place the average of nitrates excreted in urine as about 42.5 milligrams per liter. Koenig (24), Farrington and Woll (7), Uffelmann (24), Strode (54), and others, state that nitrates in fresh milk are always a sign of watering. Leffmann and Bean (1) claim to have found nitrates in ripe cheese. All investigators since early times agree that nitrates are found in water and Munz (36) in 1864 gives tables containing the data of a large number of determinations. The amounts of nitrates ingested from drinking water are small that they are of no importance in this connection.

As will be seen from the forgoing historical review, the knowledge on the origin of the nitrates in urine is very limited, Rohmann being the only one to have investigated the matter at all. Physiological chemists have evidently occupied their time on more important researches and have been willing to dismiss the subject by quoting Schoenbein. A fair example of the attitude today is well illustrated by the following quotation from Hammersten, 1908, "Nitrates occur in small quantities in human urine, probably originating from the drinking water and the food. Others, (59), fail to mention nitrates as a normal urinary constituent. As far as we know, no work has been done as to the daily output of nitrates in urine under normal conditions, and it is doubtful that the figures given for nitrates in urine were obtained by the analysis of twenty-four hour samples.

METHOD.

Schloesing's method (48) as modified by Schulze (52), Tiemann (53), Grandeau (34), and Wagner (66), was used for all the determinations, except that a few additional modifications were necessary to adapt the method for the use in the work of this experiment.

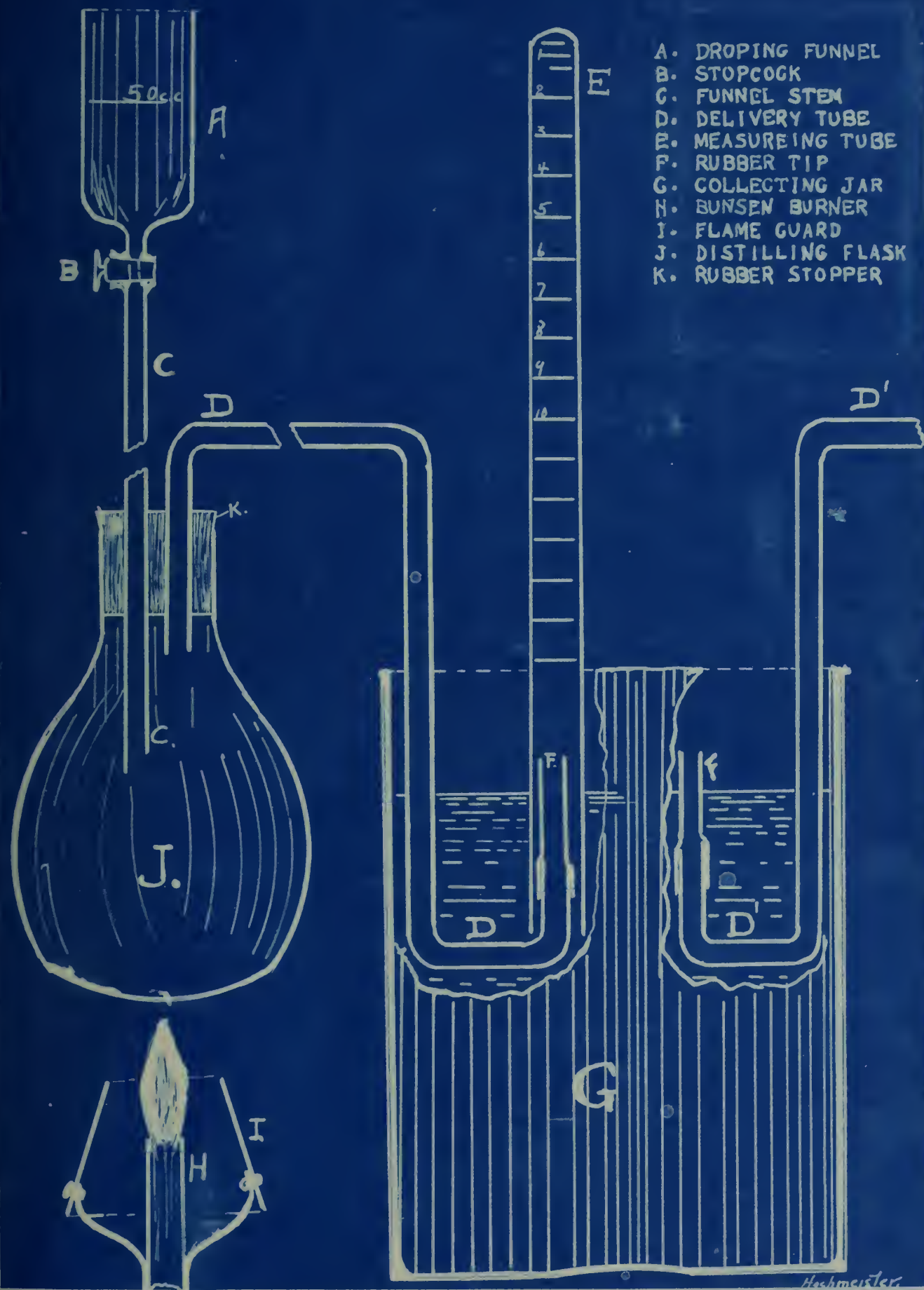
Principle:- If a nitrate or nitric acid is heated in the presence of ferrous chloride and hydrochloric acid, the nitrate or nitric acid is reduced to nitric oxide with the formation of ferric chloride, water, and the corresponding chloride, as is shown in the following equation;



From the volume of the nitric oxide, at absolute zero and a pressure of 760mm, the weight of the nitrate present is calculated.

Apparatus:- The apparatus, necessary for the determination of nitrates, as used in this investigation is shown on the next page, and consists of a 500cc cut off Kjeldahl flask F, fitted with a two hole rubber stopper K, through which are passed the stem of the dropping funnel C*, and the delivery tube D, which should reach just below the under surface of the stopper. The tube D is fitted with a tip of rubber tubing to enable one to place the graduated receiving tube in place without allowing air to get into the same. The jar G is filled to the proper level, as shown in the illustration on the next page, with strong sodium hydroxide to

* The stem of the dropping funnel must be at least 14 inches in length so that the pressure in the distilling flask will not cause the steam in the flask to blow up the stem, when the stopcock is opened.

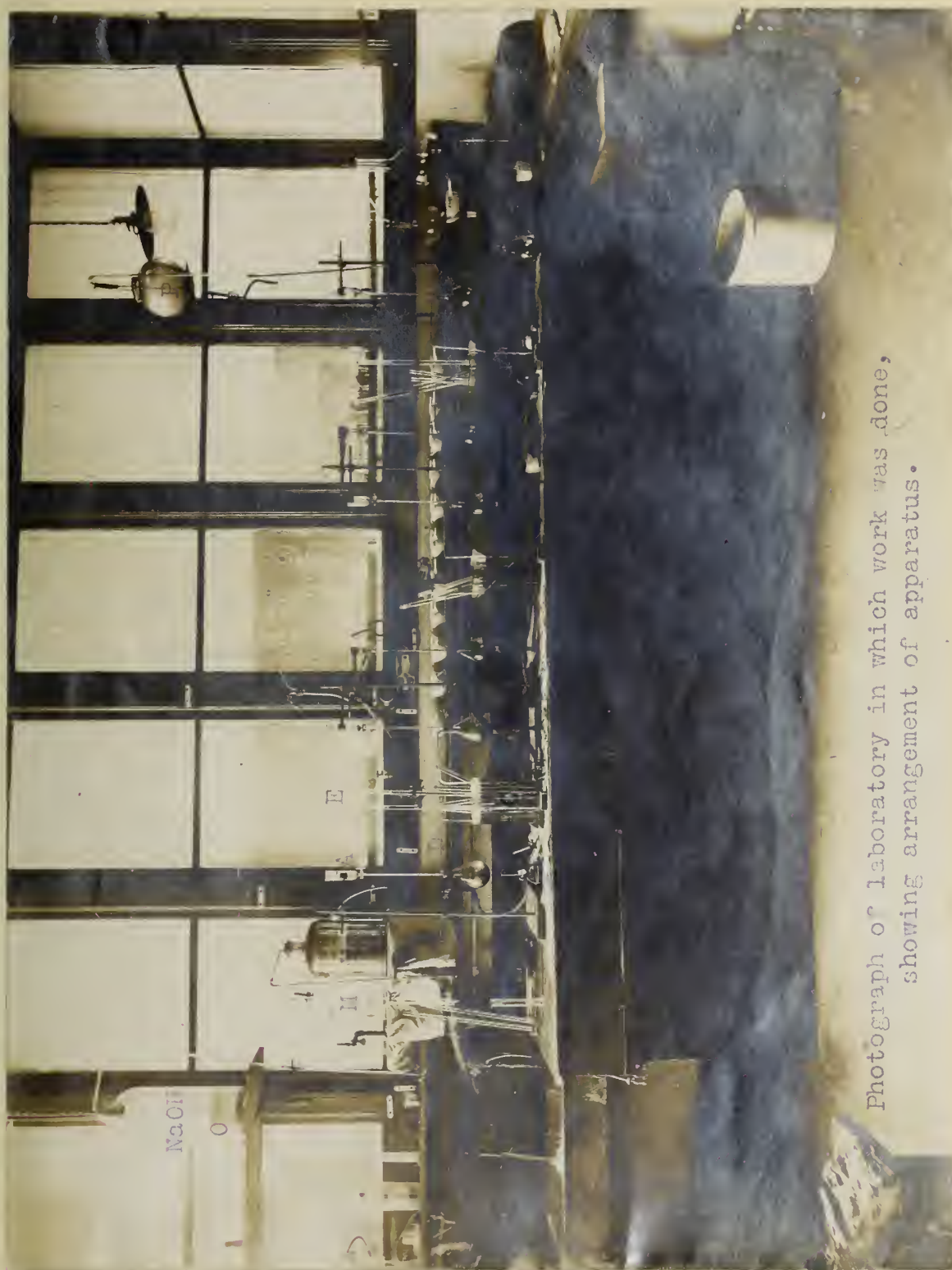


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remove the carbon dioxide given off with the nitric oxide. H is a bunsen burner, the old type is best for the purpose, as it must admit of being turned low without striking back. The flame guard H is used to keep the flame steady, as the solution in G is easily sucked back into the distilling flask should the flame be kept from the latter long enough to allow a contraction of the steam in ^{the flask.} J. Koninck (37) has a modification to prevent this sucking back, which was not used, however, this addition is valuable for the use of beginners. The ring stands and clamps are not shown in the diagram of the apparatus, but can be seen in the photograph of the apparatus and the arrangement of the same on page 14.

Solutions:- The solutions required for the determination as used are, a ferrous chloride solution, obtained by dissolving 100 grams of iron nails in one liter of concentrated hydrochloric acid, nitric acid free hydrochloric acid, specific gravity 1.10, a ten per cent solution of chemically pure caustic soda, and a strong solution of sodium hydroxide, obtained by dissolving ten pounds of Greenbanks alkali in eight liters of distilled water.

Procedure:- The material to be analyzed, after being made alkaline with the ten per cent sodium hydroxide, is evaporated to dryness on the steam bath, except in cases of direct determination of foods, feces, and small samples of water extracts. The residue is taken up with boiling water, transferred to the distilling flask and the apparatus connected as shown on the preceding page. After filling the stem of the dropping funnel with boiling water, to remove the air contained therein, the contents of the distilling



Photograph of laboratory in which work was done,
showing arrangement of apparatus.

1871
1872

flask are heated with a free flame, as shown, until steam issues freely from the delivery tube. After this has continued for a few minutes, that is until the rubber tip of the delivery tube, upon being held under the surface of the alkali in the receiving jar, shows that all the air has been expelled from the apparatus, the graduated receiving tube is filled and put in place, and the apparatus is ready for the reagent*. The reagent, consisting of 25cc of each the hydrochloric acid and the ferrous chloride, is measured into a ^Serole, heated to boiling, and carefully added to the boiling sample in the distilling flask. The reagent and the sample are now heated until all the nitric oxide has been liberated and collected in the receiving, and the mixture in the flask has been boiled almost to dryness. The rubber tip of the delivery tube is now removed from under the receiving tube, the flame is removed from under the distilling flask, and the stopcock of the dropping funnel opened. The operation must be closely watched, to see that the mass in the flask does not evaporate to complete dryness, for as soon as it does, large amounts of carbon dioxide are given off, which enter the receiver too rapidly to be absorbed. The entire

operation, not including the preparation and evaporation of the sample, takes about thirty minutes, depending somewhat on the volume of the sample, and as six determinations can be made at one time, arrangements shown on preceding page, the method allows a large number of determinations to be made in a comparatively short time. The time taken up by the reaction was utilized in preparing

* The operation of placing the filled receiving tube in place has always given much trouble which can be entirely overcome by a simple addition. The tube is filled with the strong alkali to within one half inch of the top and then completely filled with water, which is stratified on the alkali, so that a meniscus is formed. A small piece of paper is placed on the meniscus and the tube placed.

the next set, by transferring the sample to the distilling flask. The receiving tube, containing the nitric oxide, is removed to a tall jar, filled with distilled water to which sodium hydroxide has been added to remove any free air held by the water, and after cooling for one hour, the volume of the nitric oxide is read and recorded, as is the temperature of the water, and the barometric pressure at the time of reading. Rubber gloves had to be worn in this part of the work, as the mixture of water and alkali in the reading jar soon gets strong enough to eat the skin off the hands. In reading the volume of nitric oxide, a note was always made as to whether or not the characteristic brown fumes of nitric were to be seen, and it was noticed that the smallest amount that gave these fumes so that they could be seen was .6cc.

Reasons For Changing Method :- There were several reasons for modifying the method by adding the reagent to the boiling sample instead of adding the sample to the boiling reagent, according to the method as used by Richardson, and most analysts at the present time, the most important of which are, uniformity of blank, and ease of manipulation. Urine, that has been evaporated to dryness, does not go back in solution even in boiling water, so that in trying to add the sample, to the reagent in the flask, the stem of the dropping funnel would get stopped up and make it impossible to introduce the remainder of the sample. It was also impossible to make direct analysis of feces and food by using the old method. To obtain similar blanks in different determinations, according to the method as used at the present time, it is necessary to have the quantity of the sample the same in all cases. This was determined by experiment, for it was found that by varying the amount of sample, by the addition of more or less water, the blank would be increased or decreased accordingly, the difference being over .4cc in some cases. The effect of temperature is similar, heating the sample to be tested and adding while boiling, lowers the blank. For this reason 50cc of the mixed reagent were used for all determinations, this having been found sufficient by experiment, and by adding the reagent boiling hot in all determinations, the blank was kept uniform, being .2cc and never varying more than .1cc.

Blank-How Obtained:- The blank was obtained by placing 150cc of distilled water and 50cc of the mixed reagent in the distilling flask, and proceeding exactly as directed under method on pages 14 and 15. At first the following method was employed:

200cc of distilled were placed in the distilling flask, and the apparatus connected up as usual. After all the air had been expelled and the receiving tube was in place, 50cc of the mixed reagent were added by means of the dropping funnel, and the boiling continued until air ceased to come over. The receiving tube was now removed and a fresh filled tube was put in place of the one just removed. 50cc more of the boiling reagent were now added in the same way to the residue in the flask, and the blank determined. After a number of blank runs had been made in this manner, the receiving tubes were transferred to the reading jar, cooled and read. It was then found that the blanks obtained by adding the reagent to the distilled water, as in the first case, were higher than those obtained by adding the reagent to the water plus the reagent, moreover, the results obtained in the first manner varied considerable, while those in the second were quite uniform. To show the exact relation, a few of the results are given, and are as follows:-adding the boiling reagent to distilled water gave the blank determination of 0.6, 0.4, 0.5, 0.8, 0.3, 0.5, and adding the same amount of reagent to the mixture of the first we have, 0.2, 0.2, 0.25, 0.2, 0.3, 0.2. It was first thought that the difference in results was due to traces of nitrates in the water, but it was found that this was not the case, and that the error was due entirely to the difficulty of completely removing the air from water by boiling alone.

Foaming and Bumping:- In the beginning of the experimental work on urine, great difficulty was encountered owing to the foaming that took place during the operation. Rohmann, Wulfert, and

Schrode, had experienced the same difficulty, which they overcame in various ways. Rohmann, evaporated partially over asbestos, and Wulfert and Schrode by means of paraffin. Neither method worked in our case, but the difficulty was overcome by using cut off Kjeldahl flasks, 250cc round bottom flasks were first tried, and the use of a few drops of crude cottonseed oil, which with careful heating until the operation is well under way, will keep down the foam in every stage of the determination. Powdered pumice stone was used to prevent bumping.

Effect of Urinary Constituents:- The effect of creatin, urea, and uric acid upon the accuracy of the results was investigated, as it was feared that, during the operation, changes in their structure might take place that would cause error. A number of determinations were made, using 250 mgms. of creatin, 5 gms. of urea and 75 mgms. of uric acid, and it was found that in each case only the reagent blank was obtained. This was considered satisfactory evidence that the ordinary urinary constituents do not interfere in the determination of nitrates in human urine.

EXPERIMENTAL.

The experimental work, not including the work on the method, was divided into three parts, namely, the determination of nitrates in the food, the urine, and the feces, of the twenty-four members of the "Nutrition Club".

Nitrates in Food:- This part of the experimental work consisted in the determination of the nitrate content of fresh meat, cured meat, prepared cereals, canned vegetables, canned fruit, potatoes, water, and bread, besides several special investigations along similar lines.

Meat:- The meats to be analyzed were chopped fine by passing them through a meat grinder, thoroughly mixed, and sampled. Various amounts were taken for analysis, but generally 100 grams were used. The determinations were made in duplicate, or triplicate. The samples were extracted with hot water, filtered through cheesecloth, and the filtrates, after being made alkaline with ten per cent sodium hydroxide, evaporated almost to dryness on the steam bath. The residues were taken up with boiling water, transferred to the distilling flask, and after adding the cottonseed oil and pumice stone, the nitrate content determined. Second extractions and direct determinations were made at various times to check results. Besides the results tabulated on the next page, the fresh meat and the meat cured without saltpeter, used in the diet of groups A, B, and C, were analyzed at various periods, but as they were found to be free from nitrates the results are not listed. For the results of the determinations as to the nitrate content of the saltpeter cured meat, see under, Ingested Potassium Nitrate.

Nitrate Content of Foods. Meats.

2266	Fresh beef used in the preparation of dried beef----	none
2267	ditto	---
2276	Fresh beef used in the preparation of corned beef ---	none
2277	ditto	---
2271	Fresh ham used for curing -----	none
2272	ditto	none
2273	ditto	none
2274	Bacon meat used for curing -----	none
2275	ditto	---
2445	Corned beef, Uncooked -----	0.0865
2446	ditto	---
2447	ditto	---
Average-----		0.1193 *
2448	Corned beef, (same as 2445) boiled-----	0.0575
2449	ditto (same as 2446) boiled-----	0.0703
2450	ditto (same as 2447) boiled-----	0.0820
Average-----		0.0699 *
2359	Ham cured with saltpeter, uncooked-----	0.2427
2439	ditto	---
2440	ditto	---
2441	ditto	---
Average-----		0.2661 *
2442	Ham cured with saltpeter, roasted-----	0.2691
2443	ditto	---
2444	ditto	---
Average-----		0.2740 *
2358	Ham cured without saltpeter-----	none
2287	Bacon cured with saltpeter, unwashed-----	0.0921
2288	ditto	---
Average-----		0.1203
2292	Bacon cured with saltpeter, washed-----	0.1049
2293	ditto	---
Average-----		0.0954
2290	Bacon cured without saltpeter, unwashed -----	none
2291	ditto	---
Average-----		none
2302	Bacon cured without saltpeter, washed-----	none
2303	ditto	---
Average-----		none

* It is interesting to note the relative effect of boiling and roasting. The above results show that boiling the corned beef lowers the nitrate content, while roasting seems to increase the potassium nitrate content of the cured ham.

Prepared Cereals:- The cereals to be analyzed were prepared for analysis by being thoroughly mixed by passing them through a meat grinder several times, in case of cooked cereals, and mechanically mixed in case of the raw cereals, some of which were first ground to a powder in a malt mill. Water and alcohol, in various proportions, were used to extract the nitrates in the sample, and the filtrate, after being made alkaline with sodium hydroxide, evaporated to a small volume on the steam bath. The residue was transferred to the distilling flask with boiling water, and the nitrate content determined in the regular way. Second extractions and direct determinations were made in several instances to check results.

Table-- Nitrate Content of Foods. Prepared Cereals.

Lab. No.	Kind of Cereal	Amount-Grams	Per Cent KNO_3
5048	Cracked Wheat, Raw.	50	none
"	ditto	50	"
"	ditto	50	"
"	ditto	50	"
"	ditto	100	"
5047	Green of Wheat, Raw,	50	none
"	ditto	100	"
5050	Rolled Oats, Raw,	50	none
"		100	"
	Mixtures of the three, cooked,	50	none
		100	"

Canned Vegetables:-For the nitrate determination of canned vegetables several cans were used in each case. The materials were chopped in a meat bowl, thoroughly mixed and sampled. The samples were extracted with water, or with water and alcohol, and the filtrate, after partial evaporation in alkaline solution, transferred to the distilling flask with boiling water, and the nitrate content determined in the regular way. In case of tomatoes the sample was filtered through cheesecloth, and the pulp extracted with water. Second extractions and direct determinations were made at various times to check the results.

Table-Nitrate Content of Foods. Canned Vegetables.

Lab. No.	Kind of Vegetable	Amount-Grans	Per Cent KNO_3
5111	Mixed Vegetables	43	none
5132	Canned Tomatoes	200	none
"	ditto	400	"
5133	Canned Peas	200	none
5151	Canned Peas	100	none
"	ditto	100	"
	Mixed Vegetables at various times	X	none

Canned Fruits:—The Fruits to be analyzed were filtered through cheesecloth, the mass remaining on the filter squeezed dry, chopped fine in a meat bowl, and added to the filtrate, the sample for analysis being taken from this mixture. The nitrate determination in the case of fruits was made directly, a few drops of ten per cent sodium hydroxide being added to the sample to prevent losses during boiling.

Table-Nitrate Content of Foods. Fruits.

Lab. No.	Kind of Fruit	Amount-Grams	Per Cent KNO_3
5105	Mixed Fruits	50	none
5332	Canned Peaches	100	0.0004
"	ditto	100	0.0004
5339	Canned Pears	100	0.0003
"	ditto	100	0.0003
"	ditto	100	0.0003
5334	Canned Cherries	100	0.0013
"	ditto	100	0.0013
"	ditto	100	0.0013
"	ditto	100	0.0013
	Mixed Fruits at various times	100	none

Potatoes:—Potatoes were prepared for analysis in a similar manner as described under vegetables. The results showed that no nitrates were present in the raw and cooked potatoes used in the diet of the nutrition club.

Water:—The water used in the diet was analyzed at various times. The sample was taken from the tap, made alkaline, and after evaporation, determined in the regular way. The results showed that the nitrate content of the Champaign-Urbana drinking water was one milligram of potassium nitrate per liter.

In connection with the work already mentioned, but mostly to check the interesting results obtained by Richardson (), in his work on, "The Occurrence of Nitrates In Vegetable Foods, In Cured Meats And Elsewhere", a series of determinations were made to ascertain the percentage of nitrates in fresh vegetables. In the main the methods employed were the same as those used by Richardson, except that in every case the reagent blank was taken into consideration, and the modifications of the Schloessing method as used in the other work, were made use of in this connection. The sample, to be analyzed, was chopped, or cut, into small pieces, and, in nearly every case, 100 grams were taken for the analysis. The sample was extracted with water, or with water and alcohol, and the filtrate, after being made alkaline with the ten per cent sodium hydroxide, evaporated to a small volume on the steam bath. The residue was taken up with boiling water, and analyzed in the regular way. In every case a second extraction of the residue was made to determine the completeness of the first extraction, which was found to be complete in most cases, or so nearly complete that the amount of nitrate in the second extraction could be neglected. The vegetables used for the analysis, the results of which are tabulated on the next page, were obtained from the Champaign market during the latter half of January and the first week in February. The results obtained by Richardson are also shown for comparison.

Table.-Nitrates in Food. Fresh Vegetables

Lab. No.	Kind of Vegetable	NO ₃	Lab. No.	Kind of Vegetable	NO ₃
2411	lettuce	0.025	2418	Celery	0.042
2412	ditto	0.024	2419	ditto	0.074
2413	Radish	0.072	2420	Onions, Spanish	0.001
2422	ditto	0.199	2420	Onions, Green	0.005
2415	Cabbage	0.003	2427	Beets, roots	0.104
2426	ditto	0.00	2427	Beets, leaves	0.277

Results Obtained by Richardson ().

5	lettuce	0.071	1	Celery	0.171
1	ditto	0.550	5	ditto	0.129
6	Radish	0.100	5	Onions, Spanish	0.005
1	ditto	0.500	1	ditto	0.159
5	Cabbage	0.003	1	Beets	0.170
1	ditto	0.072	7	ditto	1.227

It seems strange that the results obtained by Richardson should be so much higher than those obtained in this laboratory. It is true that his samples came from the Chicago market in September, and ours were bought in the Champagne market in January and February, and therefore it is impossible to draw definite conclusions as to why these results should differ so strikingly. This much is true, however, Richardson does not take the reagent blank into consideration, as he himself stated, and it was found in the work on the method that, with small amounts of nitrates in the sample, the blank was of first importance, and the blank is, as was found by experiment, quite large in the method as employed by Richardson.

EXPERIMENTAL--PART 2.

The analysis of Urine:- The samples taken for the analysis of urine were a part of the four day composite used in the regular work. These composites were obtained as follows: The urine of each man was collected for four days, or one period, each day starting at seven o'clock on the morning of the first day and ending at seven o'clock on the morning of the next day, the period ending at seven o'clock on the morning of the fourth day, or with the collection of the fourth days sample. The urine was collected in clean dry acid bottles, that had been rinsed with alcohol containing ten per cent of thymol, and allowed to drain until dry. Each days output was measured as soon after the close of the day as possible, and immediately after the fourth day sample had been measured the composite was made. The urines were kept in cold storage when not in use, so that the reduced temperature, together with the thymol, kept them as fresh as possible. The sample of urine for analysis was taken from this composite, the nitrate content determined, and the results calculated to the yield of potassium nitrate per twenty-four hours.

500cc of urine was taken for the analysis in the case of dilute urine, and 250cc in case of the more concentrated ones. The samples were measured out in a graduated flask, poured into a casserole of the proper size, made alk. line with ten per cent sodium hydroxide, and evaporated to dryness. The dry residue was analysed as per directions on page 14-15. All determinations were made in duplicate. The results are tabulated according to groups and numbers of the men, and will be discussed later.

EXPERIMENTAL-Part 5.

Nitrates in Feces:-The samples taken for the analysis of feces were part of the regular eight day composite, used in the other work. These composites were obtained in a similar manner as outlined under urine, except that the period was eight days long and that air tight cans were used in place of bottles. From 10 to 15 grams of feces were taken in the majority of determinations, although in some instances as much as 100 grams of the sample were used. The samples were weighed directly into the distilling flask, enough water added to make a liquid mass, and after being made alkaline, determined in the usual manner. In all cases, were the sample weighed from 10 to 15 and even 20 grams, the results of the analyses showed an absence of nitrates in feces, but with larger amounts, 50 to 100 grams, a fraction of gas, over the reagent blank, was obtained. In no case was it proved that nitric oxide was present in this gas, but even if we should consider this gas to be nitric oxide, which is not the case, a mere trace be^{ing} present if any, the results obtained by calculating it to potassium nitrate are of no importance. The average amount of potassium nitrate thus obtained is 5.10 mgms., and the maximum 16 mgms. per twenty-four hours. The fraction of gas obtained in the analysis of the larger samples of feces, is thought to be due to the fact that all the air is not expelled from the apparatus, when the reagent is added. The fact that 200cc or more of water is required to form a liquid mass with the larger samples may also account for this fraction of gas, for it was shown on page 18, how difficult it is to remove all the air from water by boiling alone. An attempt was made to extract

the feces with water and to filter so as to get rid of the excess of solid matter, but the work was not successful. Sedimentation by means of a centrifuge was also tried, but as the centrifuge was burned out in trying the method the work had to stop.

It seems reasonable that the results as obtained with the smaller samples are correct. Very few soluble salts are found in the feces, so that one could hardly expect to find nitrates.

DISCUSSION OF RESULTS.

As can be seen from the following data, the subjects used in the experiment, were divided into four groups, so that for the discussion of the results of the work the same grouping will be used. Each group will be discussed separately for the three periods into which the work was divided.

General Discussion:- The experimental work was divided into three periods, the fore period, the test period, and the after period. During the fore period, periods 1 to 34 inclusive, the members of the Nutrition Club were served a normal mixed diet, made up of various amounts of fresh meat, cereals, canned vegetables, canned fruit, potatoes, bread, butter, water, and milk, cocoa, or coffee. These various ^{foods} were free of nitrates, with the exception of traces in the case of water and fruit. (see page 34) The urine excreted during this period was sampled and collected in the usual manner, but the nitrate content of the same was not determined regularly, so that the data is not complete for this period.

The test period, periods 35 to 53 inclusive, differed from the fore period in that the different groups were served different kinds of meat, or the same meat under different conditions. Group A was served the same diet as in the fore period, while group B was served with fresh meat to which a known amount of potassium nitrate had been added. Group C was served with meat cured without saltpeter, while group D was served with saltpeter cured meat once each day. The amounts of nitrate present in the diet of groups B and C, is tabulated in the following data.

After Period:-During the after period the diet was the same as in the test period except that in groups B, C, and D, a part of the subjects were served fresh meat and a part the same kind of meat as in the test period.

Group A:- As has been mention before, the subject 9, 9, 18, 16, 17, and 19, composing group A, were served practically the same diet throughout the experiment, and although the urines of this group were not analyzed regularly for nitrates, the results that were obtained are very conclusive. We find, that during the fore period, the average amount of nitrates excreted per man per twenty-four hours, calculated as potassium nitrate, to be 82.9 mgms, 76.1 mgms. during the test period, and 115.5 mgms. in the after period. The amount excreted during the after period is high owing to the irregularity of subjects 9, 17, 19, whose curves take a sudden rise at various points in the after period, for unknown reasons. The grand average for group A, taking all determinations into consideration is 89.7. The above averages of the data, and the curves shown in connection with this group, plainly shows that the present conception, of the relation of urinary nitrates to ingested nitrates, is wrong, for nitrates must be formed in the body. The experiments of Rohman on dogs and rabbits, in which he found that nitrates were not eliminated in the urine when the diet was free from the same, either do not apply or his conclusions are due to other factors than a normal mixed diet. As no other investigation is on record the results above mentioned must be considered on their own merit.

Group B:- Subjects 1, 2, 4, 3, 7, and 14, composing group B, were served fresh meat during the fore period, with fresh meat during the test period to which a known amount of potassium nitrate was added once each day, and with fresh meat during the after period, the meat as served to subjects 1, 3, 4, being the same as during the test period, while subjects 6, 7, and 14, was free from nitrates.

The grand summary curve of this group shows at a glance the group relation of the ingested to the excreted nitrates. A study of the grand summary curve, in this group, is somewhat misleading, for one might be lead to believe, that is taking the results of group A as the normal amount of potassium nitrate formed in the body, that potassium nitrate is an indifferent substance, the ingestion of which simple caused a subsequent similiar increase in the amount excreted in the urine. This is not the case, for the curve is greatly influenced by the irregularity of subject 4, whose urinary nitrate excretion is far in excess of all the others, for reasons not known. Taking the averages of the amount of potassium nitrate excreted, minus the amount ingested, for the three periods, we find that the average for the fore period is 117.6, 83.1 for the test period, and 146.3^{mgms.} for the after period. These results show that the amount of nitrates formed in the body when the diet contains nitrates to be less than the amount formed under normal conditions. This is brought out more strongly if we compare the results of this group leaving subject⁴, out of the consideration. The averages thus obtained are 63.8 for the fore period, 19.6 for the test period, and 62.5 for the after period, showing that the ingestion of potassium nitrate has an inhibitory action on the formation of

on the formation of nitrates in the body. This same fact is also brought out by subjects 1, and 3, in that shortly after potassium nitrate was added to the meat the nitrate content fell off very suddenly, also in the other subjects in that an increase in the nitrate content of the meat caused a similiar reduction in the amount excreted. The reverse is also true, that is a decrease in the nitrate content of the meat causes an increase in the amount of nitrate formed in the body.

The data of this group also shows very plainly that the volume of urine excreted in twenty-four hours does not effect the output of potassium nitrate. Taking subjects 3, and 4, for example we find that although they show the greatest variation in the amount of nitrates eliminated in the urine, their volume averages are practically the same, being 1333 and 1355cc respectively. The data also shows that the weather has nothing at all to do with the formation of nitrates in the body, for the curves show neither increase nor decrease as the weather grew warmer. The reasons for the irregularity of subjects 3, and 4, nothing can be said.

Group C:- Subjects 2, 15, 18, 22 and 25, composing group C, were served practically the same diet as group A, except that during the test period meat cured without saltpeter was substituted once each day for the fresh meat served in the fore period, and in the after period subjects 18, 21, and 25, were served meat cured without saltpeter once each day, while subjects 2, 15, and 22, were served fresh meat exclusively during the after period. Taking the average of the amounts of nitrates excreted per man per twenty-four hours, calculated as potassium nitrate, we find that the

average for the fore period is 82.2, 80.0 in the test period, and 113.9^{mgms} in the after period. The average of the after period in this case is increased by the unaccountable rise in the amounts of nitrates excreted by subjects 9, 15, and 22. The results of the test period in this group, especially subject 21, seems to show that meat cured with-out saltpeter has somewhat of an inhibitory action on the formation of nitrates in the body.

Group D:- Subject 5, 10, 11, 12, 20, and 24, composing group D, were served practically the same diet as the other groups, except that in this case meat cured with saltpeter was served during the test period instead of the fresh meat served in the fore period, and during the after period subjects 5, 12, and 20, were served saltpeter cured meat once each day, while subjects 10, 11, and 24, were served with fresh meat exclusively during the after period. Taking the average of the amounts of nitrates excreted per man per twenty-four hours, calculated as potassium nitrate, and subtract the amounts of ingested potassium nitrate, we find that the average for the fore period is 73.5 mgms., 64.3 mgms. For the test period, and 92.3 mgms. for the after period. This data as well as the grand summary, and individual curves of this group, seems to illustrate the same facts as brought out in group B, that is, that the ingested potassium nitrate has an inhibitory action on the formation of nitrates in the body. It is clearly shown in the various curves, that an increase in the amount of ingested nitrate, instead of being followed by a subsequent increase in the amounts excreted in the urine, is followed by an actual decrease instead. Subjects 10, and 12, bring out this fact most clearly, for in several instances a sudden increase in the amount of ingested potassium

nitrate caused the amounts of urinary nitrates to drop, so that the curves representing the the ingested and excreted nitrates are shown to coincide, the excreted nitrate curve even falling below in some instances. The data of this group also shows that the volume of the urine has nothing to do with the excretion of nitrates, neither has the weather.

General Discussion:- In connection with this part of the experiment, it might be well to add that in no case were nitrites found to be present in fresh urine, or in an old sample of the same that had been kept in a fresh condition by the addition of thymol, unless the sample was allowed to stand at laboratory temperature in a dilute form. The traces of nitrites that are found in fresh vegetables and saltwater cured meats are changed in the body to nitrates and eliminated as such in the urine. Whether or not appreciable amounts of nitrates or nitrites are present in the saliva or perspiration was not determined. It might be of interest to add that an average of the results obtained during the test period places the average amount of nitrates excreted in the urine during twenty-four hours, as 91.4 milligrams .

CONCLUSIONS.

- (1) Schloessing's method as used in this work is applicable for the determination of the nitrate content of food, feces, and urine.
- (2) Nitrates are present in considerable amounts in some vegetables, and in small amounts in water, cereals, and fruit.
- (3) The presence of nitrates in urine ^{is} not due entirely to the nitrates in the ingested food, but that nitrates are formed in the

body in considerable amounts, averaging about 90 mgm. in twenty-four hours.

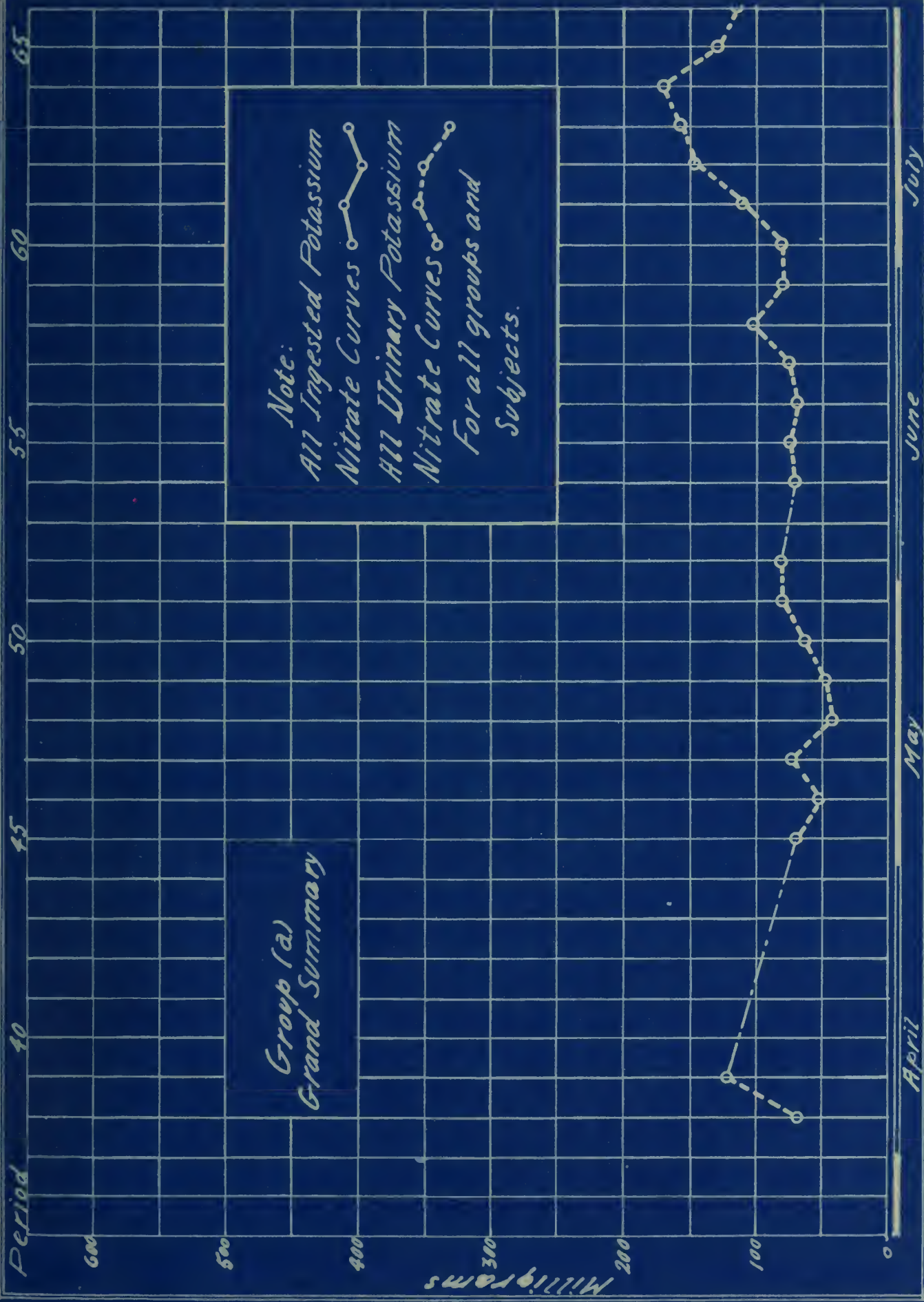
(4) The relation of the ingested potassium nitrate to the nitrate found to be present in the urine is not clearly understood, the data showing that ingested potassium nitrate has an inhibitory action on the formation of nitrates in the body. In all cases the urinary nitrate was found to be present in larger amounts than that ingested except in one case.

(5) In no case was it definitely proven that nitrates are present in feces.

(6) Neither urine nor feces were found to contain nitrites.

(7) The formation of nitrates in the body is not influenced by the weather, and the volume of urine excreted in twenty-four hours has nothing to do with the amounts of nitrate found in the urine.

(8) The conclusions of Rohman, that nitrates are not formed in the body but are due entirely to the nitrates present in the food, and the general opinion held by leading physiological chemists today, that this is true, are not based on actual experiments on man, and are therefore of little value.

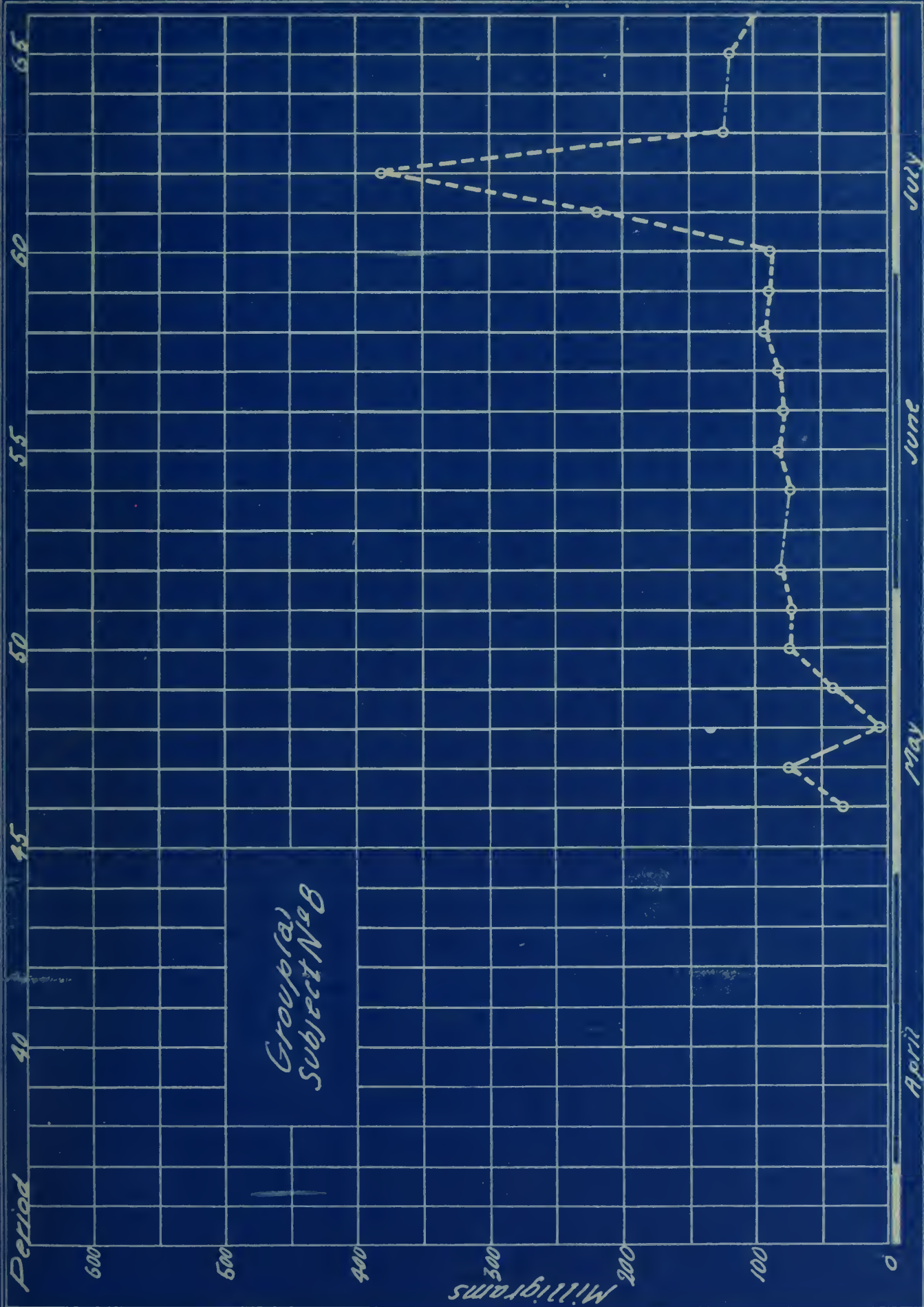


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Urinary Nitrates per Man per Day, Group(A), Subject(8).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO_3 per 24 hours m-grams
6134	6 Nov.29-D.2	812	155.8	none
6154	7 Dec. 3-6	814	109.3	"
6181	8 " 7-10	736	107.0	"
6448	19 Jan.20-23	945	105.0	"
6488	21 " 28-31	777	87.4	"
....	Average	817	112.9	none
....	Minimum	736	87.4	"
....	Maximum	945	155.1	"
8081	46 May 7-10	749	35.1	none
8118	47 " 11-14	654	77.3	"
8131	48 " 15-18	62	7.0	"
8168	49 " 19-22	689	43.6	"
8178	50 " 23-26	660	76.9	"
8222	51 " 27-30	761	74.9	"
8225	52 " 31-J.3	819	82.5	"
8274	54 June 8-11	673	76.2	"
8318	55 " 12-15	712	84.1	"
8321	56 " 16-19	660	70.7	"
8366	57 " 20-23	584	74.9	"
8372	58 " 24-27	624	95.0	"
....	Average	684	66.5	none
....	Minimum	62	7.0	"
....	Maximum	819	95.0	"
8410	59 June28-Jy.1	597	91.7	none
8431	60 July 2-5	631	90.9	"
8455	61 " 6-9	600	221.3	"
8482	62 " 10-13	622	385.2	"
8492	63 " 14-17	581	126.9	"
8532	64 " 18-21	646	.....	"
8547	65 " 22-25	619	121.2	"
8574	66 " 26-29	625	101.7	"
....	Average	615	142.4	none
....	Maximum	646	385.2	"
....	Minimum	581	90.9	"

Group (a)
Subject No 8

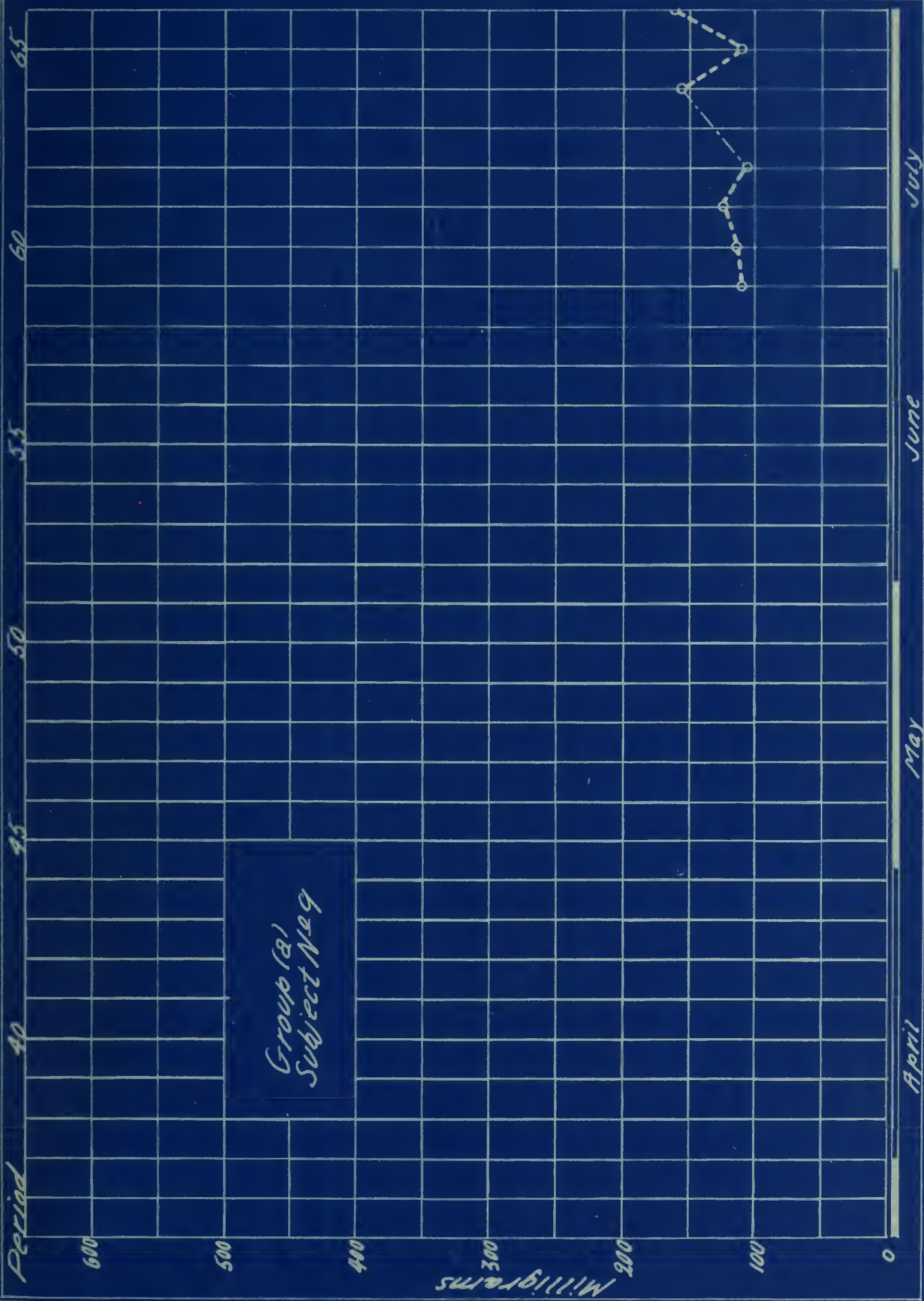


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Urinary Nitrates per Man per Day, Group(A), Subject(9).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6734	31 Mar. 8-11	3374	37.4	none
....	Average	....	....	....
....	Minimum	....	....	....
....	Maximum	....	....	....
8346	57 June 20-23	709	99.9	none
....	Average	....	....	....
....	Minimum	....	....	....
....	Maximum	....	....	....
8405	59 June 28-Jy.1	1736	111.9	none
8422	60 July 2-5	1370	115.9	"
8444	61 " 6-9	1685	126.4	"
8474	62 " 10-13	757	108.4	"
8507	63 " 14-17	....	....	"
8517	64 " 18-21	1566	157.3	"
8559	65 " 22-25	1577	111.2	"
8561	66 " 26-29	932	162.1	"
....	Average	1375	127.6	none
....	Minimum	757	108.4	"
....	Maximum	1736	162.1	"

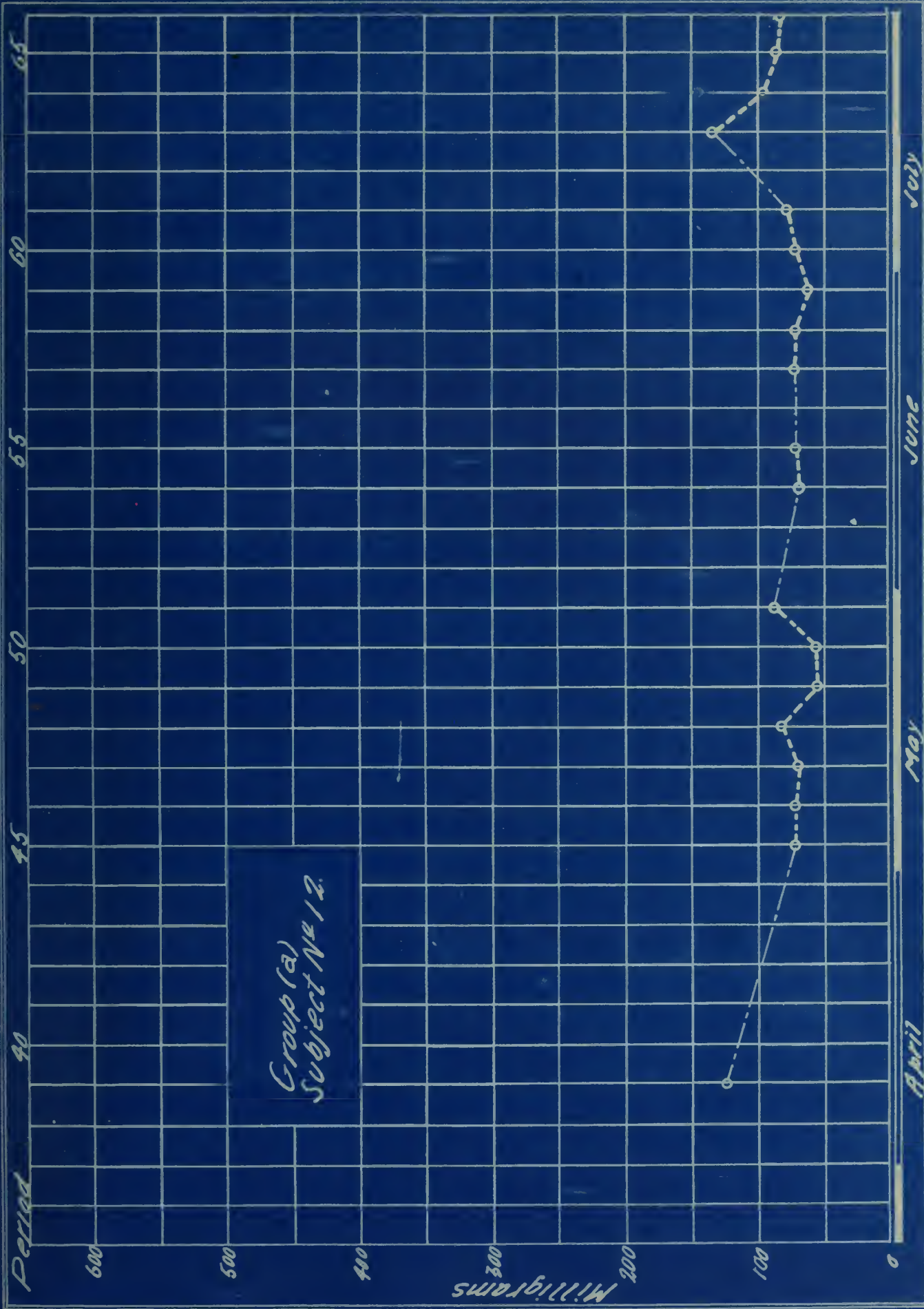


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Urinary Nitrates per Man per Day, Group(A), Subject(12).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6415	39 Apr. 9-11	757	122.3	none
8063	45 May 3-6	966	70.2	"
8093	46 " 7-10	806	70.9	"
8126	47 " 11-14	793	69.2	"
8146	48 " 15-18	865	81.7	"
8163	49 " 19-22	783	54.4	"
8184	50 " 23-26	701	55.7	"
8214	51 " 27-30	741	87.4	"
8283	54 June 8-11	939	68.1	"
8309	55 " 12-15	865	70.7	"
8350	57 " 20-23	607	71.7	"
8387	58 " 24-27	891	70.4	"
....	Average	809	74.4	none
....	Minimum	607	54.4	"
....	Maximum	966	122.3	"
8402	59 June 28-Jy.1	665	62.6	none
8435	60 July 2-5	605	70.4	"
8454	61 " 6-9	740	78.3	"
8484	62 " 10-13	573	.....	"
8489	63 " 14-17	786	133.8	"
8535	64 " 18-21	658	95.5	"
8544	65 " 22-25	696	86.1	"
8576	66 " 26-29	678	81.8	"
....	Average	675	76.1	none
....	Minimum	573	62.6	"
....	Maximum	786	133.8	"

Group (a)
Subject No 12.



July

June

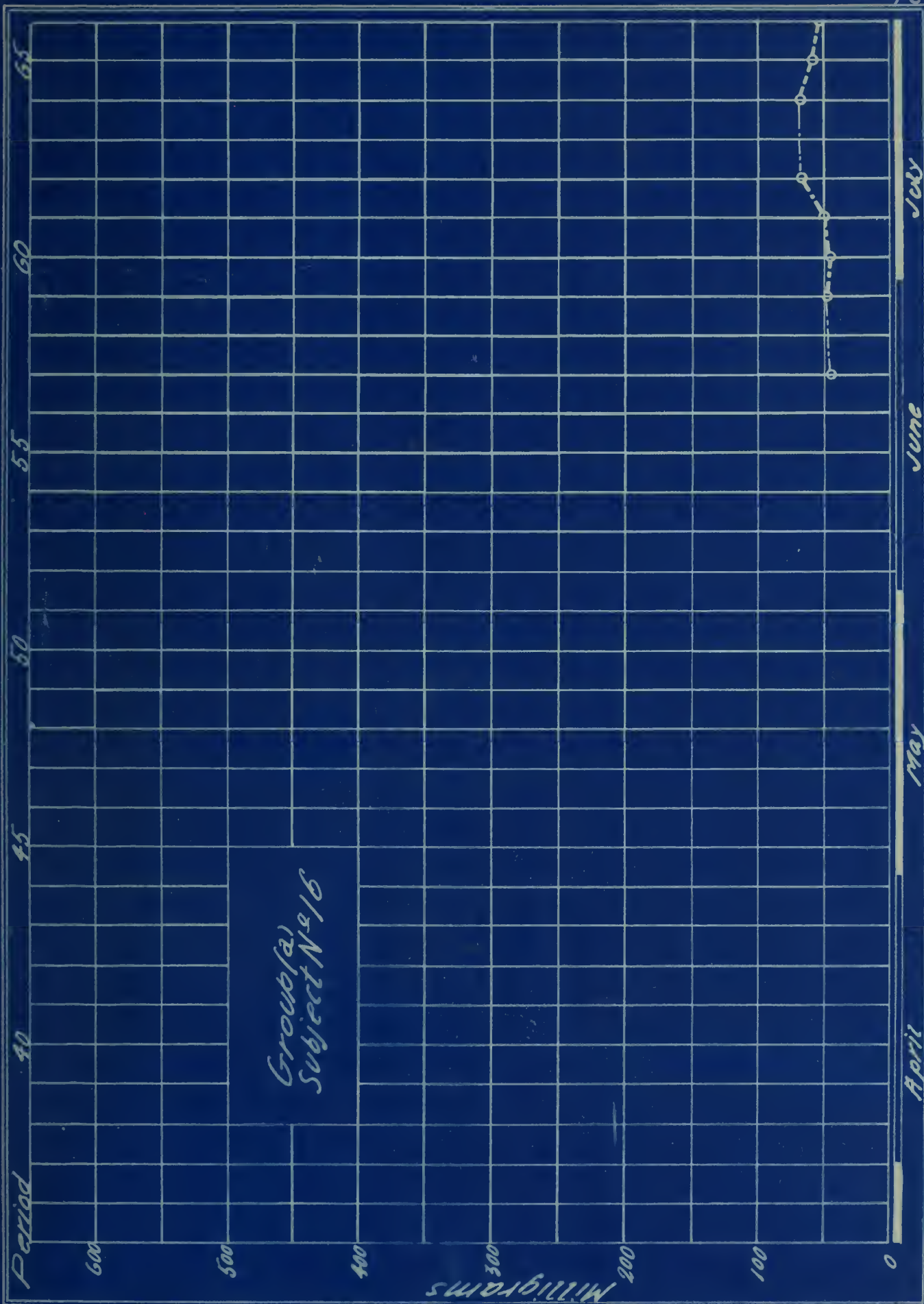
May

April

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Urinary Nitrates per Man per Day, Group(A), Subject(16).

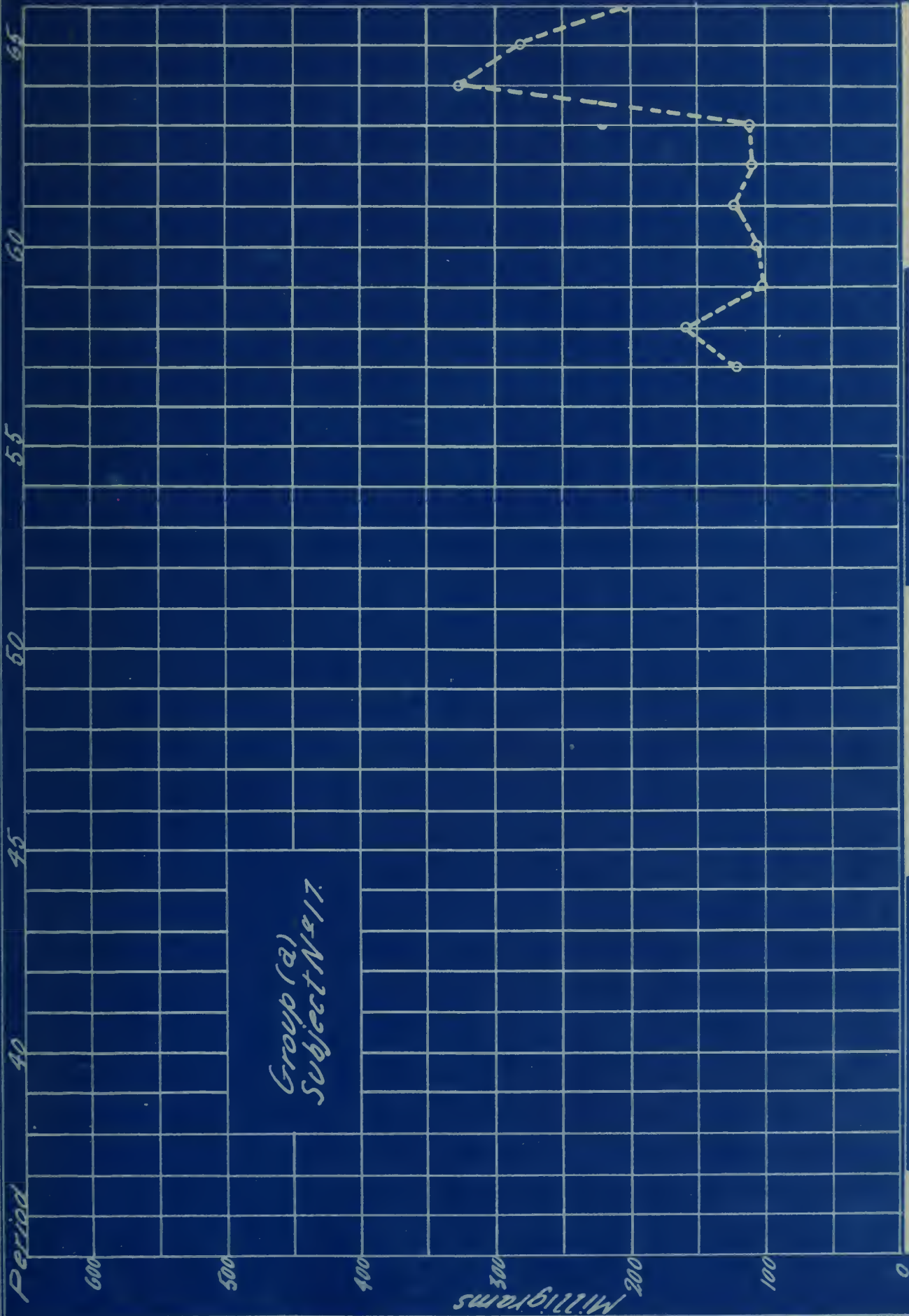
Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
8721	31 Mar. 8-11	1059	53.6	none
....	Average	....	....	"
....	Minimum	....	....	"
....	Maximum	....	....	"
8349	57 June 20-23	860	45.5	none
....	Average	....	....	"
....	Minimum	....	....	"
....	Maximum	....	....	"
8407	59 June 28-Jy.1	1179	48.8	none
8421	60 July 2-5	878	45.7	"
8443	61 " 6-9	1217	50.3	"
8477	62 " 10-13	740	68.5	"
8523	64 " 18-21	1317	68.8	"
8541	65 " 22-25	1249	59.8	"
8579	66 " 26-29	1046	51.8	"
....	Average	1089	56.2	none
....	Minimum	740	45.7	"
....	Maximum	1317	68.8	"



Urinary Nitrates per Man per Day, Group(A), Subject(17).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6143	6 Nov.29-D.2	1177	142.7	none
6145	7 Dec. 3-6	853	138.1	"
6176	8 " 7-10	1108	93.6	"
6438	19 Jan.20-23	909	172.2	"
6491	21 " 28-31	862	100.6	"
6738	31 Mar. 8-11	848	130.3	"
....	Average	959	130.6	none
....	Minimum	848	93.6	"
....	Maximum	1177	172.2	"
8362	57 June20-23	706	121.7	none
8376	58 " 24-27	652	159.2	"
....	Average	679	140.4	none
....	Minimum	652	121.7	"
....	Maximum	706	159.2	"
8411	59 June28-Jy.1	731	102.5	none
8419	60 July 2-5	613	106.0	"
8446	61 " 6-9	812	123.8	"
8473	62 " 10-13	639	110.3	"
8509	63 " 14-17	734	111.6	"
8515	64 " 18-21	770	328.0	"
8557	65 " 22-25	755	281.9	"
8563	66 " 26-29	745	204.5	"
....	Average	725	171.1	none
....	Minimum	613	102.5	"
....	Maximum	812	328.0	"

Group (a)
Subject No 17



July

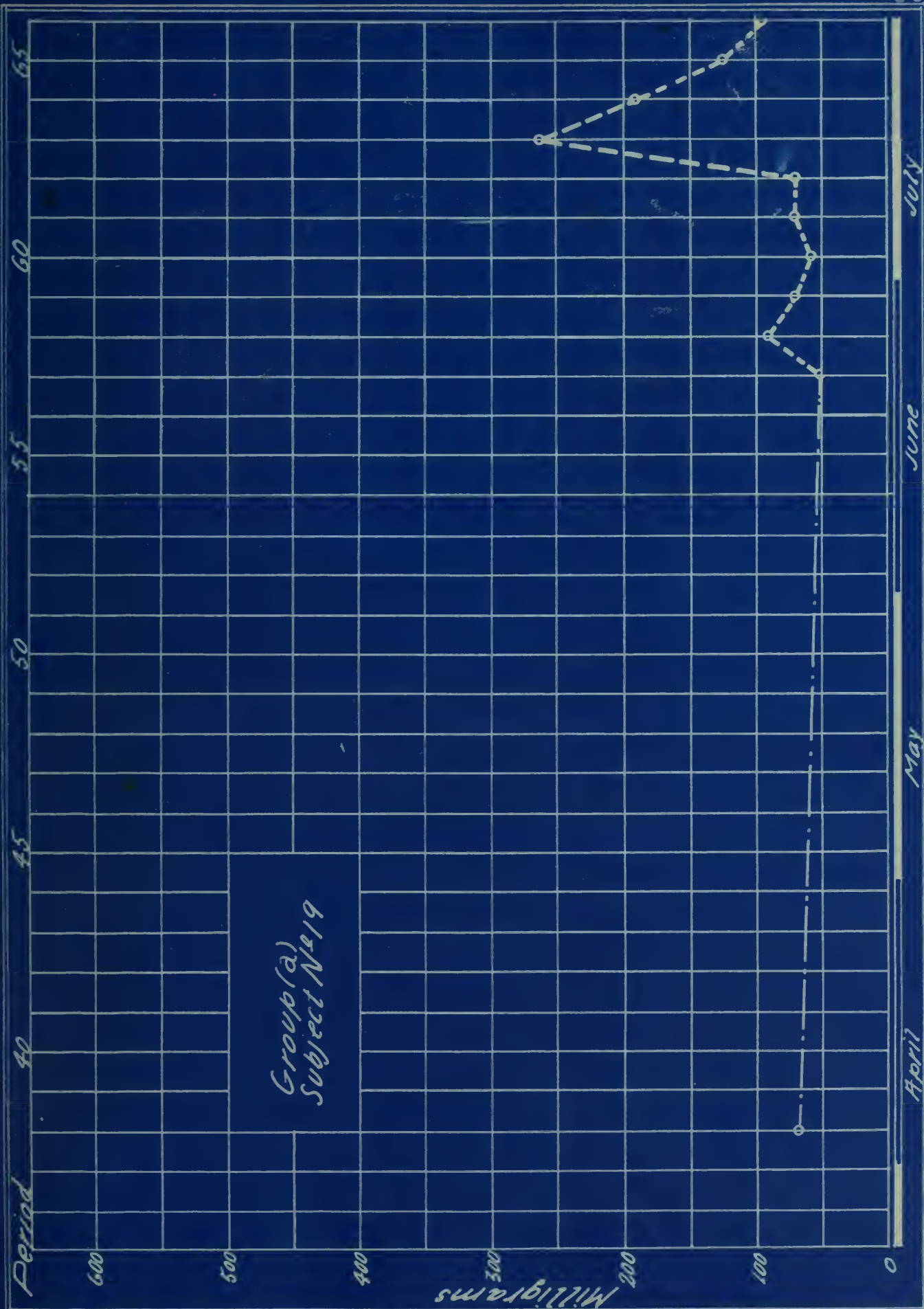
June

May

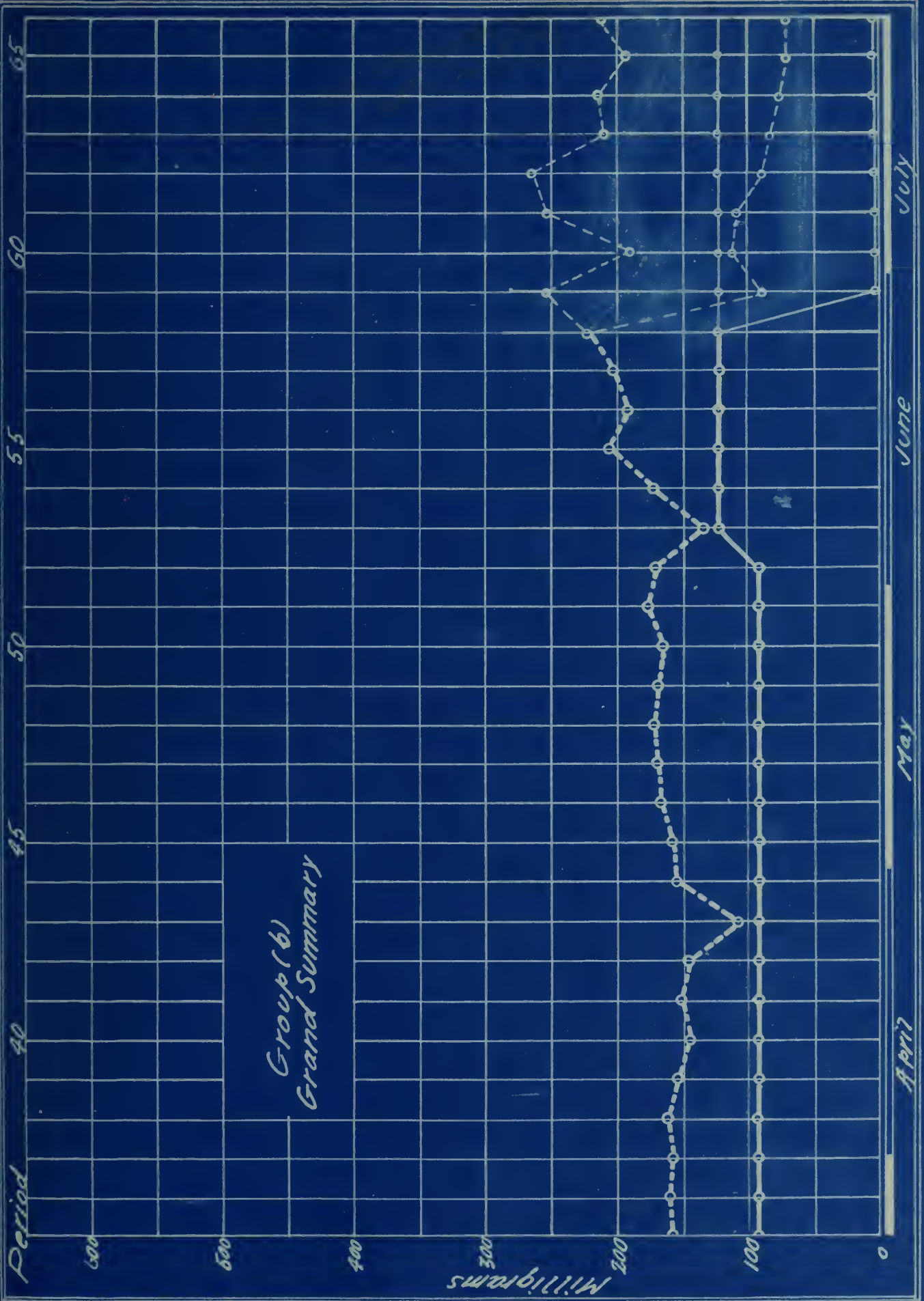
April

Urinary Nitrates per Man per Day, Group(A), Subject(19).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6153	7 Dec. 3-6	1602	127.8	none
6179	8 " 7-10	1508	61.5	"
6453	19 Jan. 20-23	1775	81.4	"
6458	20 " 24-27	1649	62.8	"
6502	21 " 28-31	1554	83.5	"
6727	31 Mar. 8-11	1470	61.5	"
....	Average	1593	80.3	none
....	Minimum	1470	61.5	"
....	Maximum	1775	127.8	"
6901	38 Apr. 5-8	1709	69.1	none
8365	57 June 20-23	922	50.6	"
8373	58 " 24-27	1163	90.2	"
....	Average	1265	70.0	none
....	Minimum	922	50.6	"
....	Maximum	1709	90.2	"
8412	59 June 28-Jy. 1	1216	71.4	none
8450	60 July 2-5	1086	59.3	"
8456	61 " 6-9	1094	71.8	"
8468	62 " 10-13	887	71.6	"
8504	63 " 14-17	1297	266.0	"
8520	64 " 18-21	1581	193.3	"
8552	65 " 22-25	1555	127.0	"
8568	66 " 26-29	1172	96.6	"
....	Average	1236	119.6	none
....	Minimum	887	59.3	"
....	Maximum	1581	266.0	"

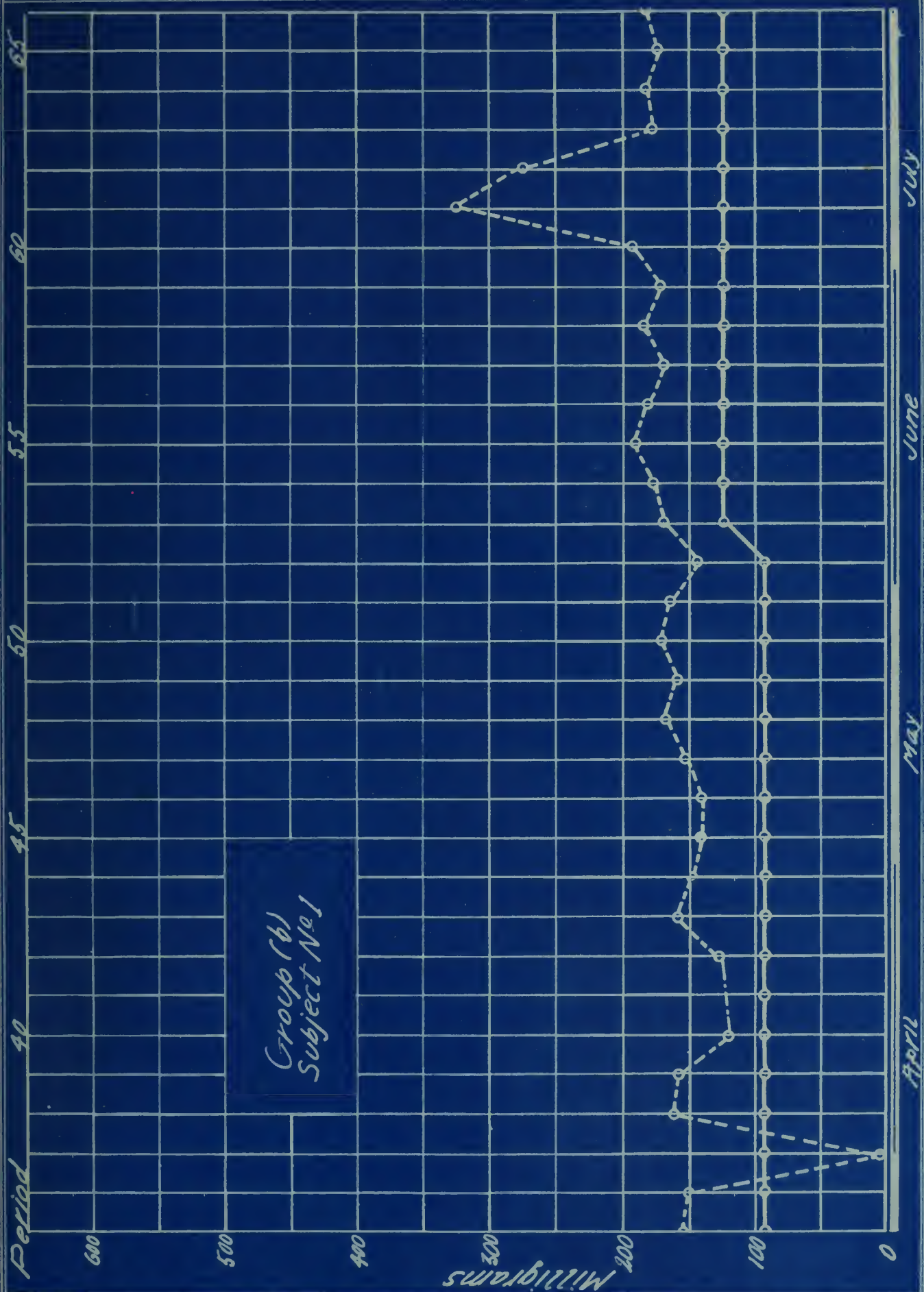


LETTER
TO THE
REVEREND FATHERS OF THE
CONGREGATION OF THE HOLY SACRAMENT



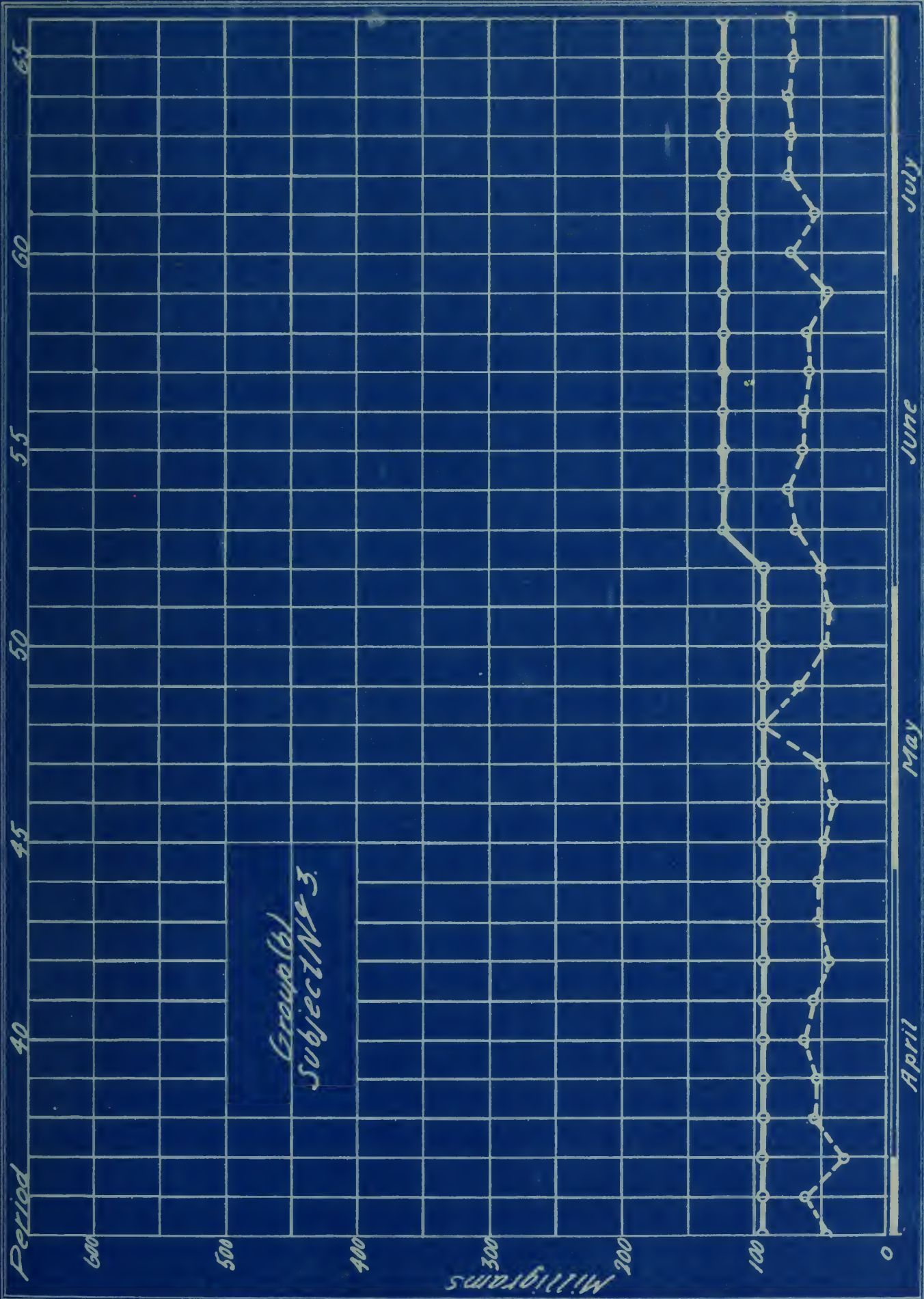
Urinary Nitrates per Man per Day, Group(B), Subject(1).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ Per 24 hours m-grams
6739	31 Mar. 8-11	1677	67.7	none
....	Average	....	....	....
....	Minimum	....	....	....
....	Maximum	....	....	....
6838	35 Mar. 24-27	1168	153.6	93.2
6848	36 " 28-31	1298	150.3	"
6868	37 Apr. 1-4	1231	3.0	"
6895	38 " 5-8	1179	161.4	"
6936	39 " 9-12	1125	158.9	"
6939	40 " 13-16	1197	120.1	"
6987	42 " 21-24	1203	128.6	"
8022	43 " 25-28	1356	159.3	"
8043	44 " 29-M.2	1345	148.8	"
8067	45 May 3-6	1496	141.6	"
8086	46 " 7-10	1286	141.2	"
8116	47 " 11-14	1012	151.1	"
8129	48 " 15-18	778	168.0	"
8165	49 " 19-22	1092	159.8	"
8182	50 " 23-26	936	171.3	"
8218	51 " 27-30	950	164.5	"
8232	52 " 31-J.3	1043	144.5	"
8264	53 June 4-7	807	169.4	124.3
8277	54 " 8-11	1008	178.5	"
8317	55 " 12-15	1548	190.8	"
8342	56 " 16-19	1071	182.7	"
8345	57 " 20-23	661	169.8	"
8390	58 " 24-27	1093	185.6	"
....	Average	1125	152.3	100.6
....	Minimum	661	3.0	93.2
....	Maximum	1548	190.8	124.3
8396	59 June 28-Jy.1	893	172.4	124.3
8432	60 July 2-5	892	194.2	"
8463	61 " 6-9	849	326.6	"
8486	62 " 10-13	655	276.9	"
8493	63 " 14-17	983	179.0	"
8531	64 " 18-21	1090	184.4	"
8548	65 " 22-25	991	175.3	"
8575	66 " 26-29	663	183.1	"
....	Average	877	211.5	124.3
....	Minimum	665	172.4	124.3
....	Maximum	1090	326.6	124.3



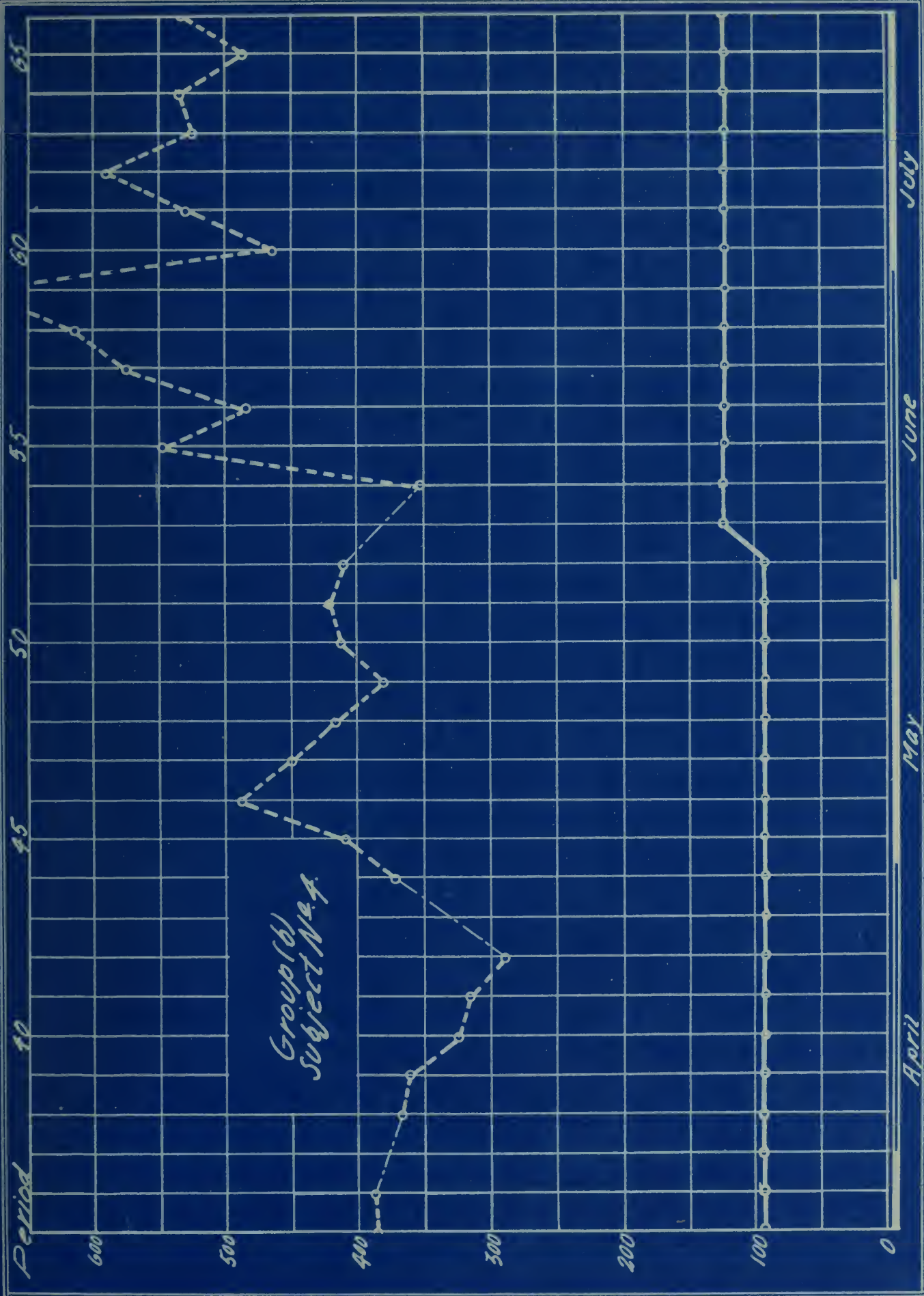
Urinary Nitrates per Man per Day, Group(B), Subject(3).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6744	31 Mar. 8-11	1369	40.3	
....	Average	....	....	none
....	Minimum	....	....	....
....	Maximum	....	....	....
6817	35 Mar. 24-27	1169	46.6	93.2
6847	36 " 28-31	1787	61.8	"
6869	37 Apr. 1-4	1594	32.8	"
6900	38 " 5-8	1434	55.2	"
6931	39 " 9-12	1604	53.0	"
6941	40 " 13-16	1565	63.8	"
6980	41 " 17-20	1239	56.7	"
6989	42 " 21-24	1636	45.7	"
8027	43 " 25-28	1658	52.9	"
8034	44 " 29-M.2	1544	52.2	"
8075	45 May 3-6	1590	48.0	"
8092	46 " 7-10	1433	41.6	"
8110	47 " 11-14	1270	50.5	"
8134	48 " 15-18	1005	95.1	"
8174	49 " 19-22	1265	66.2	"
8190	50 " 23-26	1211	47.6	"
8201	51 " 27-30	1119	46.3	"
8247	52 " 31-J.3	1746	50.8	"
8253	53 June 4-7	887	69.6	124.3
8291	54 " 8-11	1138	75.7	"
8299	55 " 12-15	1272	65.1	"
8333	56 " 16-19	1172	64.4	"
8354	57 " 20-23	893	60.8	"
8384	58 " 24-27	1192	62.1	"
....	Average	1363	61.1	100.6
....	Minimum	887	32.8	93.2
....	Maximum	1787	95.1	124.3
8399	59 June 28-Jy.1	1064	46.0	124.3
8425	60 July 2-5	1047	73.3	"
8451	61 " 6-9	1172	56.5	"
8467	62 " 10-13	576	75.7	"
8502	63 " 14-17	786	73.9	"
8522	64 " 18-21	1348	75.8	"
8542	65 " 22-25	1172	71.7	"
8578	66 " 26-29	946	74.4	"
....	Average	1014	68.4	124.3
....	Minimum	576	46.0	"
....	Maximum	1348	75.8	"



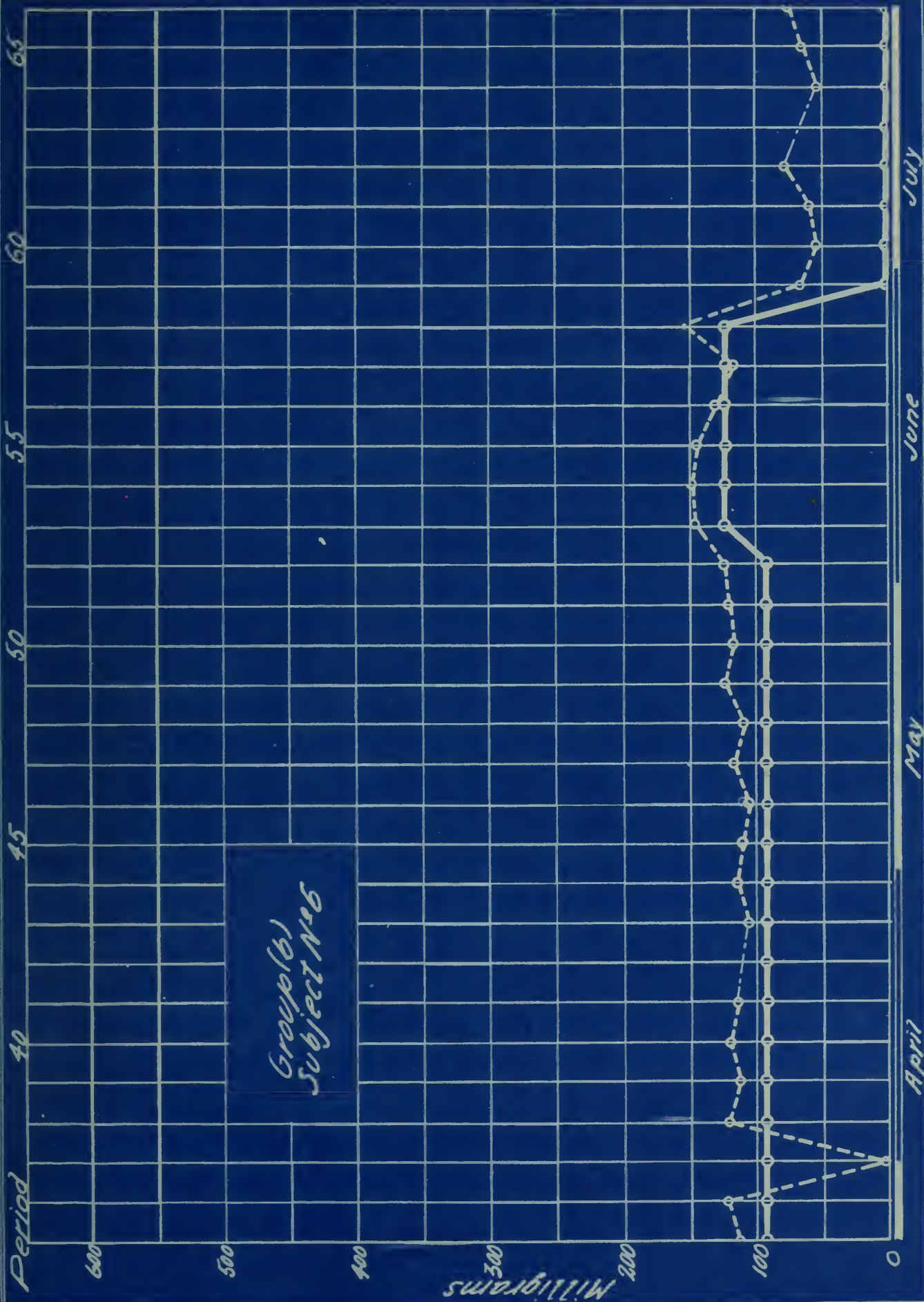
Urinary Nitrates per Man per Day, Group(B), Subject(4).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrates 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6132	6 Nov.29-D.2	2155	359.2	none
6156	7 Dec. 3-6	1680	265.4	"
6185	8 " 7-10	1485	225.6	"
6441	19 Jan.20-23	1869	265.5	"
6470	20 " 24-27	1719	215.0	"
6496	21 " 27-30	1646	193.6	"
6730	31 Mar. 8-11	1468	440.8	"
....	Average	1717	253.1	none
....	Minimum	1465	193.6	"
....	Maximum	2155	440.8	"
6837	35 Mar.24-27	1279	387.2	93.2
6850	36 " 28-31	1609	388.5	"
6891	38 Apr. 5-8	1438	368.1	"
6928	39 " 9-12	1393	361.7	"
6944	40 " 13-16	1388	325.3	"
6977	41 " 17-20	1252	317.7	"
6992	42 " 21-24	1378	290.5	"
8041	44 " 29-M.2	1720	372.5	"
8071	45 May 3-6	1750	410.7	"
8082	46 " 7-10	1662	489.8	"
8108	47 " 11-14	1154	450.1	"
8141	48 " 15-18	1033	418.7	"
8154	49 " 19-22	1341	381.6	"
8193	50 " 23-26	1397	414.6	"
8205	51 " 27-30	1552	422.3	"
8245	52 " 31-J.3	1662	412.1	"
8286	54 June 8-11	1201	352.1	124.3
8306	55 " 12-15	1277	549.3	"
8327	56 " 16-19	1064	486.9	"
8361	57 " 20-23	938	576.4	"
8379	58 " 24-27	998	615.8	"
....	Average	1355	418.6	100.6
....	Minimum	938	290.5	93.2
....	Maximum	1750	615.8	124.3
8415	59 June28-Jy.1	1055	690.6	124.3
8417	60 July 2-5	1121	465.2	"
8448	61 " 6-9	1065	531.9	"
8472	62 " 10-13	861	591.3	"
8511	63 " 14-17	1175	527.2	"
8513	64 " 18-21	1207	536.5	"
8555	65 " 22-25	1008	488.9	"
8565	66 " 26-29	1092	535.0	"
....	Average	1073	545.8	124.3
....	Minimum	861	465.2	"
....	Maximum	1207	690.6	"



Urinary Nitrates per Man per Day, Group(B), Subject(6).

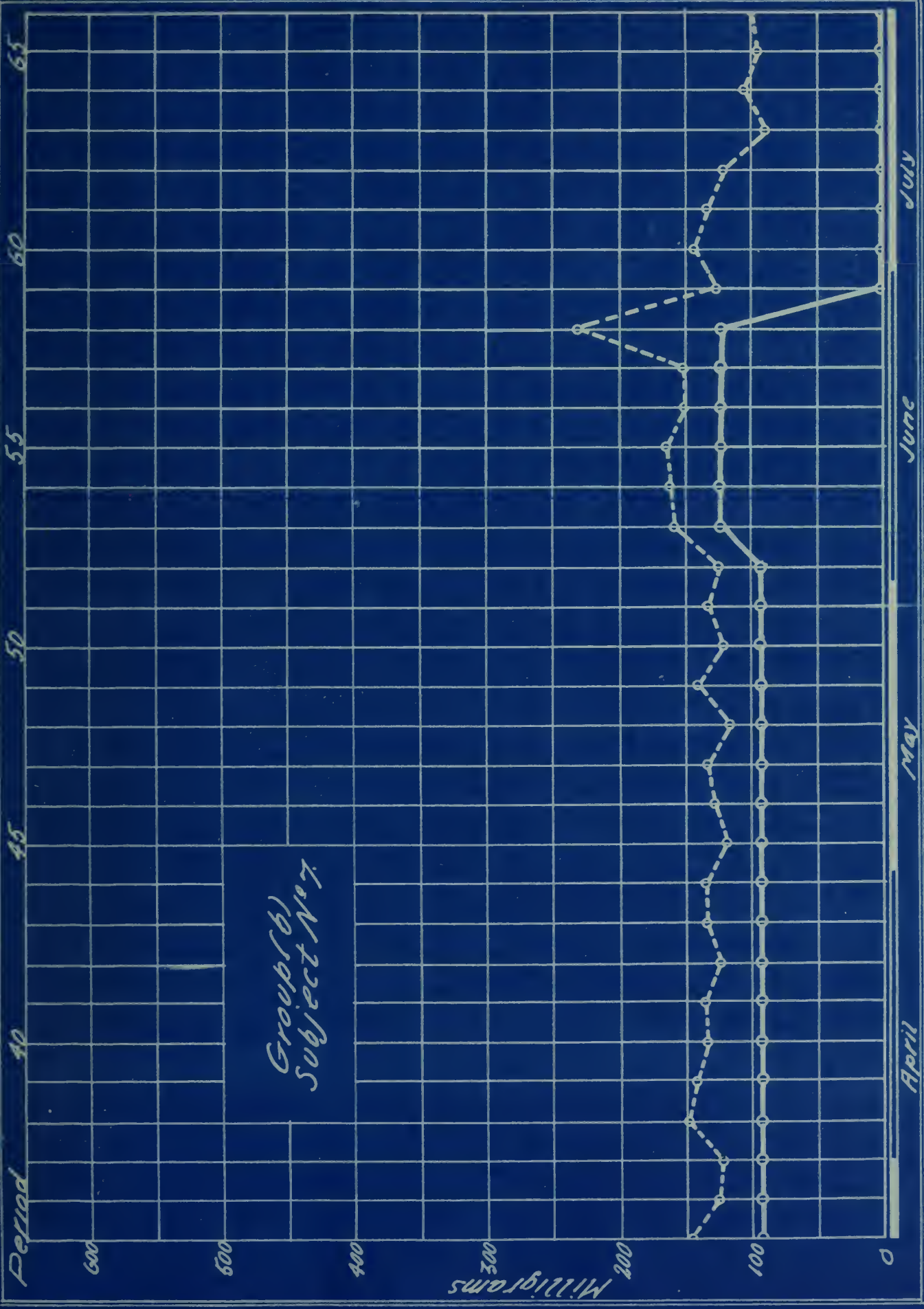
Lab. No.	Period- Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours. m-grams
6124	6 Nov.29-D.2	1235	94.3	none
6164	7 Dec. 3-6	1117	65.3	"
6175	8 " 7-10	1143	65.0	"
6471	20 Jan.24-27	1384	60.5	"
6495	21 " 28-31	1063	57.1	"
6736	31 Mar. 8-11	1104	58.6	"
....	Average	1174	66.8	none
....	Minimum	1063	57.1	"
....	Maximum	1384	94.3	"
6831	35 Mar.24-27	943	113.7	93.2
6851	36 " 28-31	1174	122.9	"
6874	37 Apr. 1-4	1041	4.2	"
6907	38 " 5-8	1120	121.7	"
6913	39 " 9-12	992	114.0	"
6954	40 " 13-16	957	120.7	"
6967	41 " 17-20	1056	115.5	"
8015	43 " 25-28	1181	107.2	"
8056	44 " 29-M.2	1066	115.4	"
8072	45 May 3-6	1438	111.5	"
8083	46 " 7-10	1317	106.8	"
8114	47 " 11-14	922	118.0	"
8137	48 " 15-18	929	110.5	"
8171	49 " 19-22	1192	124.1	"
8185	50 " 23-26	916	118.0	"
8212	51 " 27-30	926	121.7	"
8233	52 " 31-J.3	1334	125.5	"
8262	53 June 4-7	908	146.1	124.3
8281	54 " 8-11	1224	149.2	"
8311	55 " 12-15	1230	145.9	"
8339	56 " 16-19	1014	131.6	"
8348	57 " 20-23	718	118.7	"
8388	58 " 24-27	907	152.1	"
....	Average	1065	118.0	101.2
....	Minimum	718	4.2	93.2
....	Maximum	1438	152.1	124.3
8400	59 June28-JY.1	987	68.4	none
8436	60 July 2-5	892	54.5	"
8461	61 " 6-9	876	60.9	"
8487	62 " 10-13	758	79.8	"
8495	63 " 14-17	1011	....	"
8529	64 " 18-21	1169	54.6	"
8550	65 " 22-25	944	65.6	"
8570	66 " 26-29	784	77.2	"
....	Average	928	65.9	none
....	Minimum	758	54.5	"
....	Maximum	1169	79.8	"



Urinary Nitrates per Man per Day, Group(B), Subject(7).

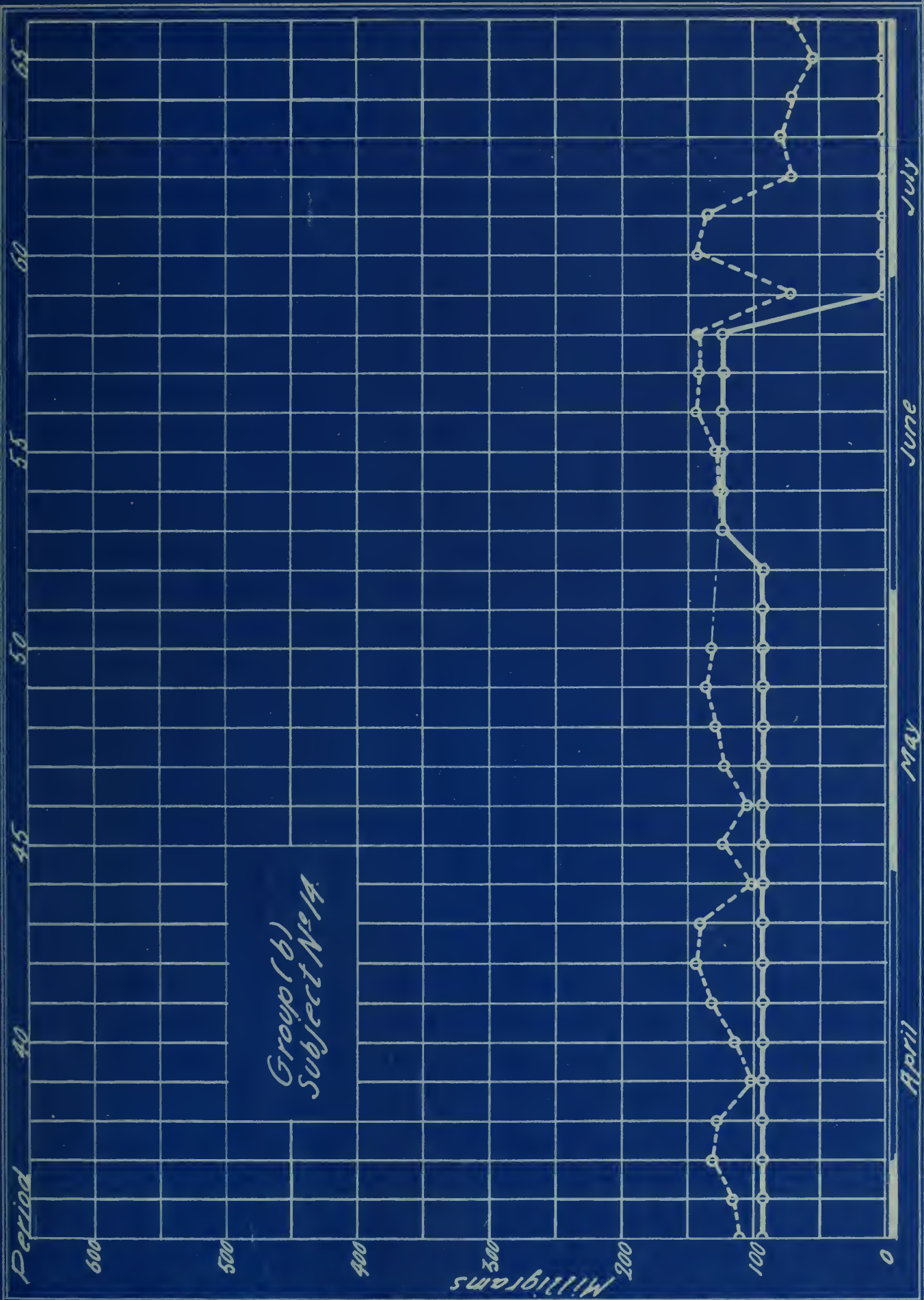
Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6130	6 Nov.29-D.2	990	119.2	none
6158	7 Dec. 3-6	1179	98.7	"
6190	8 " 7-10	1146	76.9	"
6739	31 Mar. 8-11	1223	71.5	"
....	Average	1134	91.6	none
....	Minimum	990	71.5	"
....	Maximum	1223	119.2	"
6820	35 Mar.24-27	971	146.6	93.2
6852	36 " 28-31	1246	126.2	"
6867	37 Apr. 1-4	1501	122.9	"
6896	38 " 5-8	1305	149.0	"
6935	39 " 9-12	870	143.5	"
6937	40 " 13-16	956	134.0	"
6984	41 " 17-20	1093	136.5	"
6985	42 " 21-24	1117	125.6	"
8020	43 " 25-28	1149	135.0	"
8046	44 " 29-M.2	1101	135.8	"
8061	45 May 3-6	1573	120.5	"
8095	46 " 7-10	1430	129.5	"
8117	47 " 11-14	1036	134.9	"
8132	48 " 15-18	775	118.3	"
8170	49 " 19-22	966	141.0	"
8180	50 " 23-26	801	122.9	"
8220	51 " 27-30	889	136.4	"
8228	52 " 31-J.3	1586	127.6	"
8268	53 June 4-7	809	160.0	124.3
8278	54 " 8-11	1168	163.5	"
8314	55 " 12-15	1081	165.4	"
8323	56 " 16-19	1234	150.7	"
8363	57 " 20-23	743	152.2	"
8381	58 " 24-27	1176	182.8	"
....	Average	1107	140.0	100.9
....	Minimum	743	118.3	93.2
....	Maximum	1586	182.8	124.3
8393	59 June28-Jy.1	1072	127.1	none
8428	60 July 2-5	888	144.6	"
8453	61 " 6-9	1097	135.4	"
8481	62 " 10-13	633	121.9	"
8494	63 " 14-17	1188	90.6	"
8530	64 " 18-21	1136	106.6	"
8549	65 " 22-25	1166	97.9	"
8571	66 " 26-29	888	100.6	"
....	Average	1008	113.6	none
....	Minimum	633	90.6	"
....	Maximum	1188	144.6	"

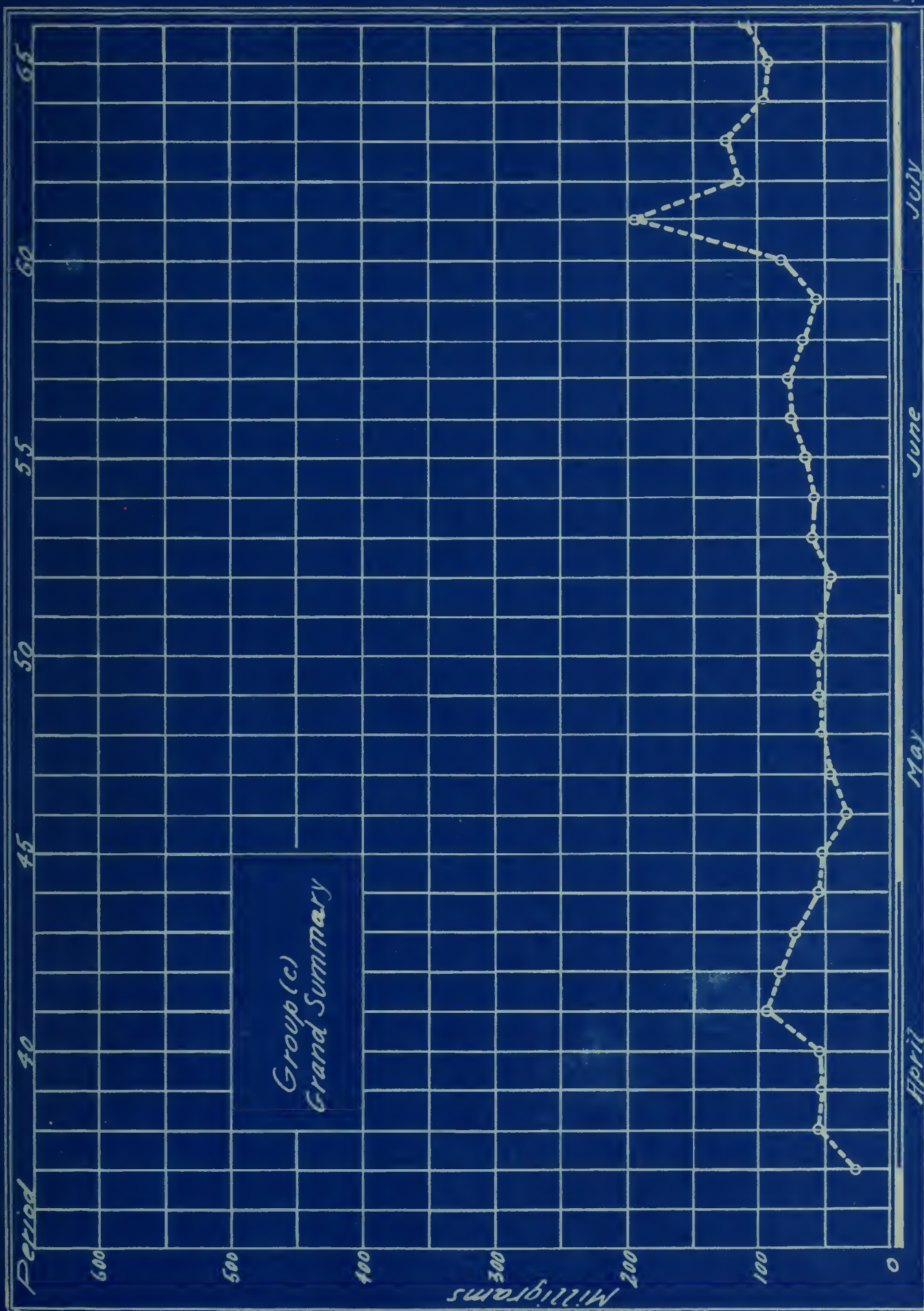
Group (b)
Subject No. 7



Urinary Nitrates per Man per Day, Group(B), Subject(14).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6133	6 Nov.29-D.2.	1120	100.4	none
6155	7 Dec, 3-6	1261	95.7	"
6183	8 " 7-10	1480	68.6	"
6465	20 Jan.24-27	1858	63.3	"
6490	21 " 28-31	1818	44.3	"
6723	31 Mar. 8-11	209	33.0	"
....	Average	1291	67.5	none
....	Minimum	209	33.0	"
....	Maximum	1858	100.4	"
6827	35 Mar.24-27	1555	111.2	93.2
6853	36 " 28-31	1989	117.3	"
6878	37 Apr. 1-4	1952	132.7	"
6909	38 " 5-8	1775	129.5	"
6923	39 " 9-12	1871	102.9	"
6949	40 " 13-16	1528	116.5	"
6972	41 " 17-20	1400	134.3	"
6997	42 " 21-24	1383	145.7	"
8023	43 " 25-28	1615	141.3	"
8040	44 " 29-M.2	1815	101.5	"
8074	45 May. 3-6	1862	124.0	"
8091	46 " 7- 10	1632	107.7	"
8111	47 " 11-14	1058	122.4	"
8133	48 " 15-18	885	130.4	"
8171	49 " 19-22	1327	138.8	"
8186	50 " 23-26	1023	133.3	"
8289	54 June 8-11	1435	128.5	124.3
8297	55 " 12-15	1263	130.2	"
8332	56 " 16-19	1125	145.0	"
8356	57 " 20-23	637	142.3	"
8383	58 " 24-27	1365	144.2	"
....	Average	1452	127.6	100.5
....	Minimum	637	101.5	93.2
....	Maximum	1989	145.7	124.3
8397	59 June28-Jy.1	1561	74.0	none
8426	60 July 2-5	1490	144.3	"
8452	61 " 6-9	1218	137.7	"
8470	62 " 10-13	658	73.9	"
8508	63 " 14-17	1087	80.4	"
8516	64 " 18-21	1481	73.2	"
8558	65 " 22-25	917	56.1	"
8562	66 " 26-29	616	71.1	"
....	Average		71.1	none
....	Minimum		56.1	"
....	Maximum	1561	145.7	"



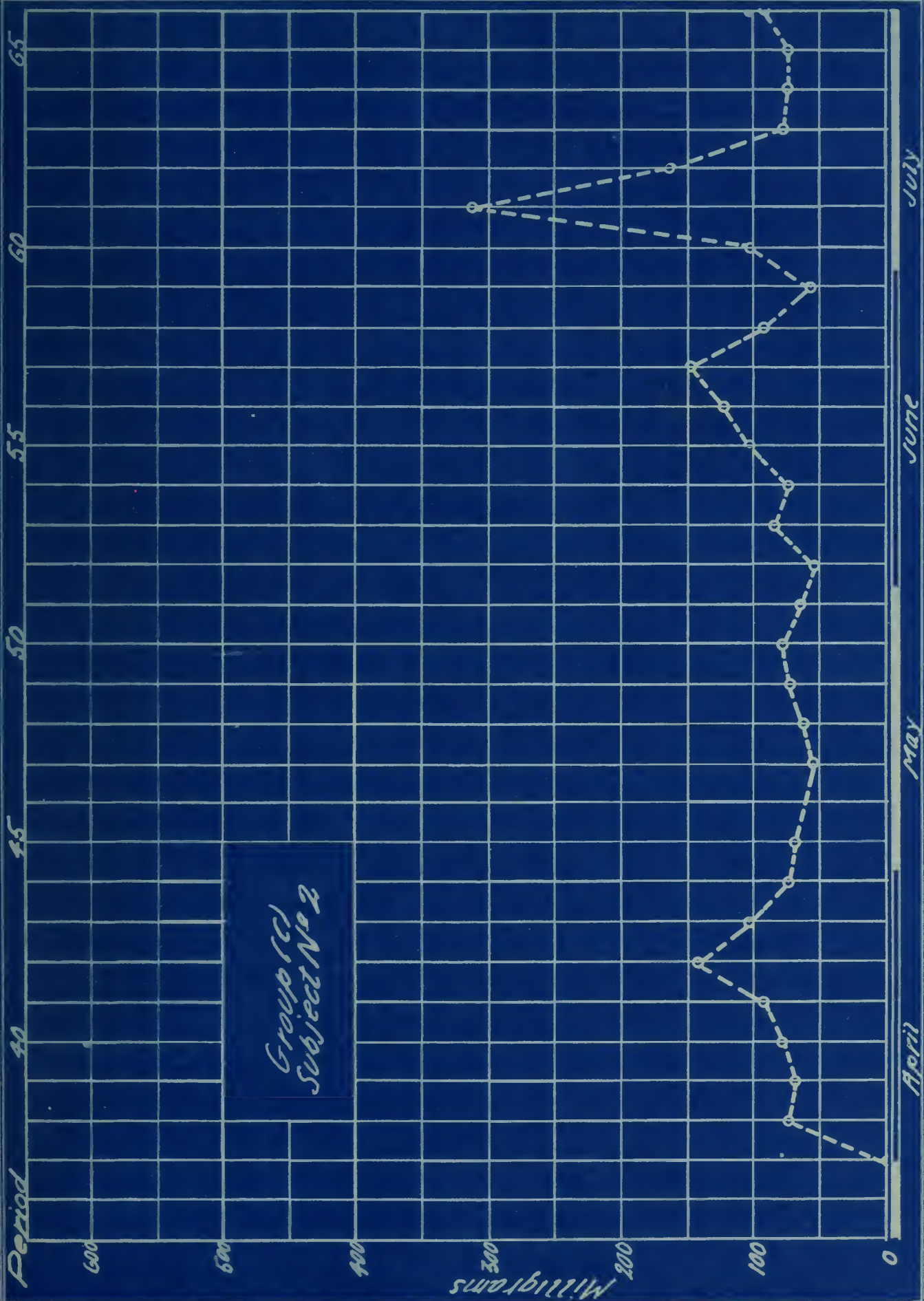


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Urinary Nitrates per Man per Day, Group(C), Subject(2).

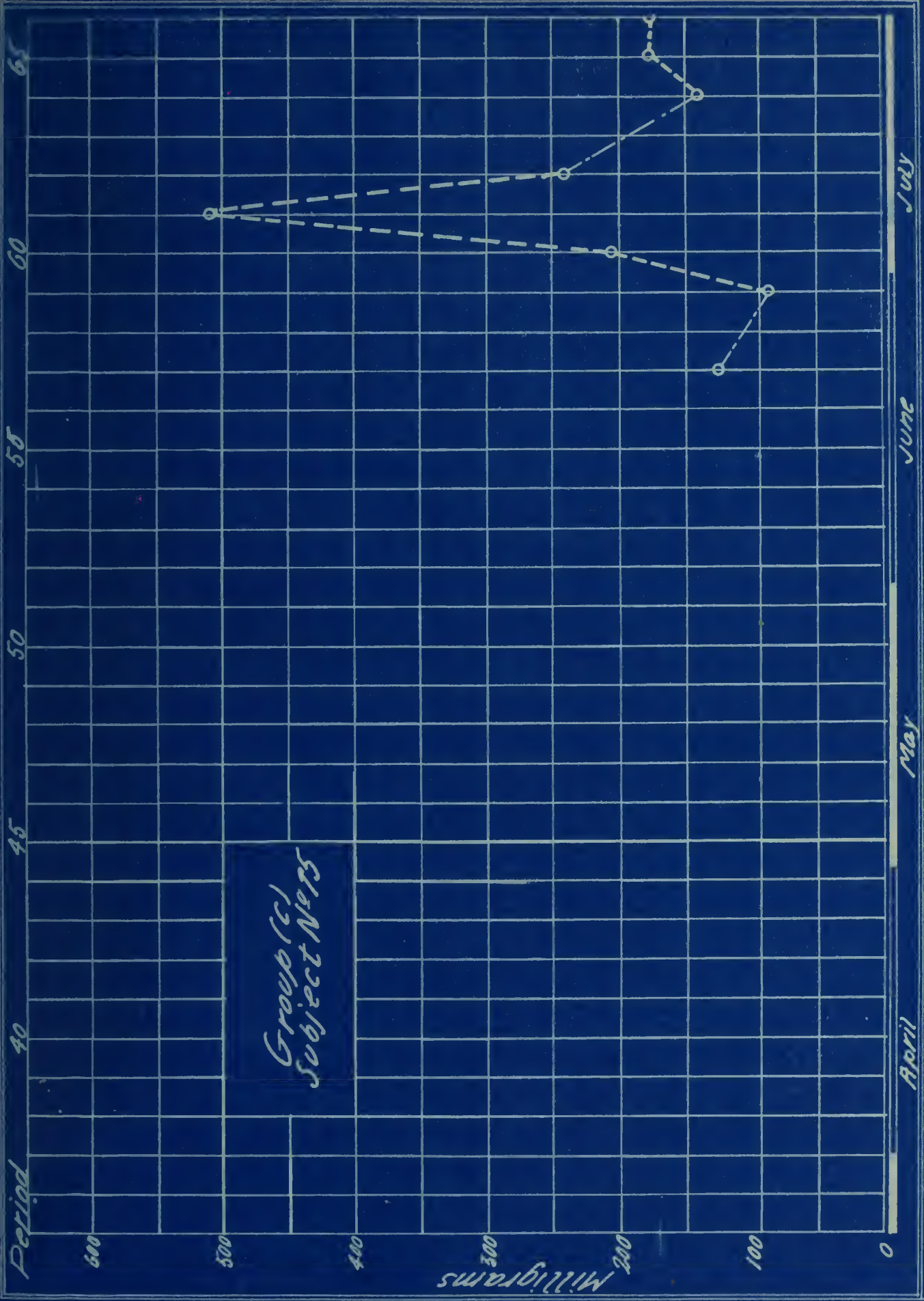
Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6467	20 Jan.24-27	1815	156.0	none
6494	21 " 28-31	1586	114.5	"
6735	31 Mar.8-11	1808	75.7	"
....	Average	1736	115.4	"
....	Minimum	1586	75.7	"
....	Maximum	1815	156.0	"
6870	37 Apr. 1-4	1290	00.	"
6899	38 " 5-8	1667	75.3	"
6932	39 " 9-12	1420	69.6	"
6940	40 " 13-16	1565	79.2	"
6981	41 " 17-20	1446	93.1	"
6988	42 " 21-24	1526	144.1	"
8026	43 " 25-28	1852	104.2	"
8033	44 " 29-M.2	1564	76.8	"
8073	45 May 3-6	1858	70.1	"
8106	47 " 11-14	1305	56.0	"
8138	48 " 15-18	1545	63.1	"
8169	49 " 19-22	1355	73.5	"
8179	50 " 23-26	1343	80.5	"
8223	51 " 27-30	1005	64.1	"
8226	52 " 31-J.3	1585	55.2	"
8270	53 June 4-7	1118	86.0	"
8276	54 " 8-11	1459	76.2	"
8316	55 " 12-15	1532	103.7	"
8322	56 " 16-19	1617	123.1	"
8367	57 " 20-23	1027	149.0	"
8371	58 " 24-27	1460	94.7	"
....	37-58 Average	1454	82.7	"
....	" " Minimum	1005	55.2	"
....	" " Maximum	1858	149.0	"
8408	59 June 28-J.1	1592	59.2	"
8432	60 July 2-5	1531	103.0	"
8458	61 " 6-9	1448	313.0	"
8466	62 " 10-13	840	165.4	"
8499	63 " 14-17	1433	79.7	"
8528	64 " 18-21	1428	77.8	"
8539	65 " 22-25	1089	76.5	"
8580	66 " 26-29	866	92.5	"
....	59-66 Average	1278	120.9	"
....	" " Minimum	840	59.2	"
....	" " Maximum	1592	313.0	"

Group (C)
Subject No 2



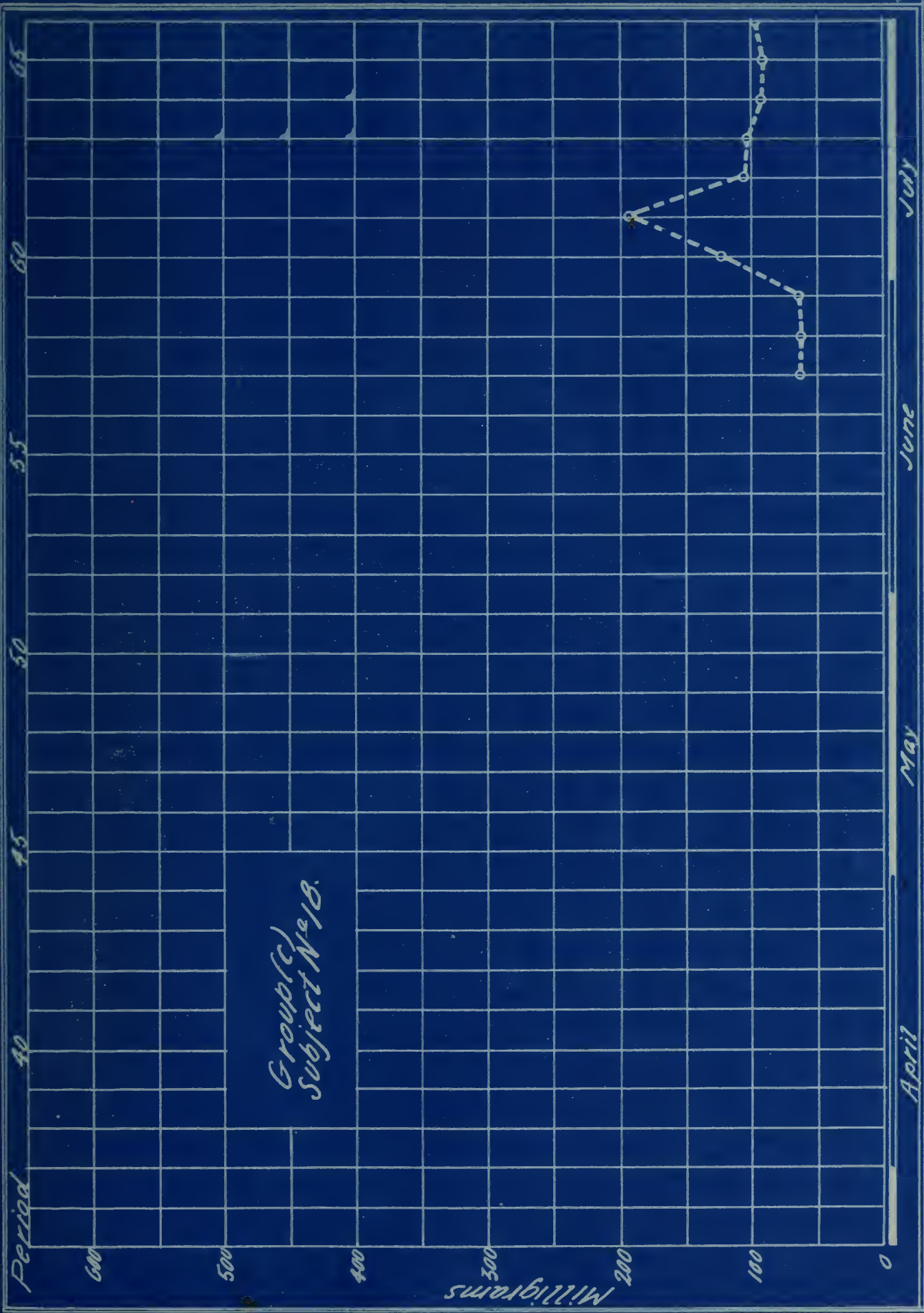
Urinary Nitrates per Man per Day, Group(C), Subject(15).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6129	6 Nov. 29-D.2	1101	126.5	none
6737	31 Mar. 8-11	1058	133.1	"
....	Average	1029	129.8	none
....	Minimum	1058	126.5	"
....	Maximum	1101	133.1	"
8353	57 June 20-23	833	126.9	none
....	Average	....	....	"
....	Minimum	....	....	"
....	Maximum	....	....	"
8404	59 June 28-J.1	944	98.6	none
8434	60 July 2-5	820	207.2	"
8441	61 " 6-9	811	511.5	"
8476	62 " 10-13	716	242.4	"
8521	64 " 18-21	1095	140.8	"
8543	65 " 22-25	912	178.5	"
8577	66 " 26-29	950	178.3	"
....	Average	893	222.5	none
....	Minimum	716	98.6	"
....	Maximum	1095	511.5	"



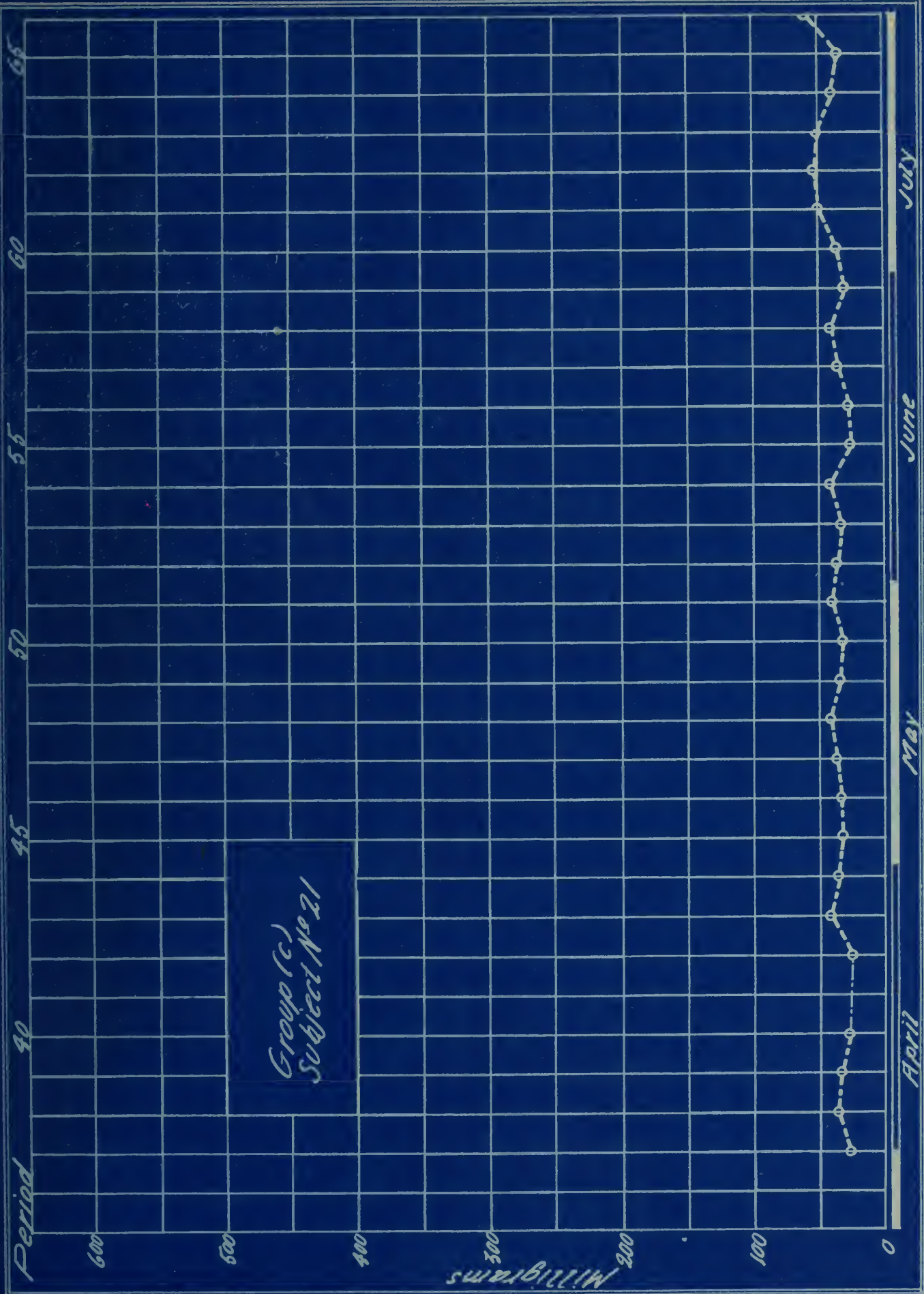
Urinary Nitrates per Man per Day, Group(C), Subject(18).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6075	4 Nov.21-24	1133	106.5	none
6172	8 Dec. 7-10	1118	63.6	"
6436	19 Jan.20-23	1002	63.8	"
6475	20 " 24-27	1111	68.4	"
6487	21 " 28-31	1004	48.9	"
6743	31 Mar. 8-11	1216	80.4	"
....	Average	1096	71.9	none
....	Minimum	1002	48.9	"
....	Maximum	1216	106.3	"
8358	57 June20-23	761	65.3	none
8377	58 " 24-27	769	64.3	"
....	Average	765	64.8	none
....	Minimum	761	64.3	"
....	Maximum	769	65.3	"
8409	59 June28-Jy.1	789	66.5	none
8420	60 July 2-5	784	126.3	"
8445	61 " 6-9	708	194.3	"
8478	62 " 10-13	559	107.9	"
8500	63 " 14-17	896	103.1	"
8524	64 " 18-21	915	94.3	"
8540	65 " 22-25	709	92.0	"
8582	66 " 26-29	931	97.4	"
....	Average	786	110.2	none
....	Minimum	559	66.5	"
....	Maximum	931	194.3	"



Urinary Nitrates per Man per Day, Group(C), Subject(21).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24,hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6720	31 Mar. 8-11	928	7.3	none
....	Average	...	...	....
....	Minimum	...	...	....
....	Maximum	...	...	....
6884	37 Apr. 1-4	1007	27.9	none
6897	38 " 5-8	1020	37.2	"
6934	39 " 9-12	869	36.9	"
6938	40 " 13-16	901	29.6	"
6986	42 " 21-24	991	26.1	"
8021	43 " 25-28	1044	43.1	"
8044	44 " 29-M.2	979	37.8	"
8065	45 May 3-6	1261	33.9	"
8088	46 " 7-10	1035	34.2	"
8125	47 " 11-14	1013	39.1	"
8143	48 " 15-18	949	42.9	"
8159	49 " 19-22	850	36.5	"
8195	50 " 23-26	799	34.3	"
8209	51 " 27-30	856	41.7	"
8239	52 " 31-J.3	994	38.9	"
8258	53 June 4-7	854	35.8	"
8267	54 " 8-11	867	43.3	"
8305	55 " 12-15	1097	28.8	"
8336	56 " 16-19	852	29.8	"
8351	57 " 20-23	755	37.7	"
8386	58 " 24-27	722	42.7	"
....	Average	939	36.1	none
....	Minimum	850	26.1	"
....	Maximum	1261	43.3	"
8403	59 June 28-Jy.1	780	32.4	none
8423	60 July 2-5	711	38.9	"
8449	61 " 6-9	852	49.9	"
8480	62 " 10-13	727	53.8	"
8497	63 " 14-17	845	50.5	"
8527	64 " 18-21	953	40.1	"
8537	65 " 22-25	903	36.0	"
8581	66 " 26-29	852	61.0	"
....	Average	828	50.7	none
....	Minimum	711	32.4	"
....	Maximum	953	61.0	"

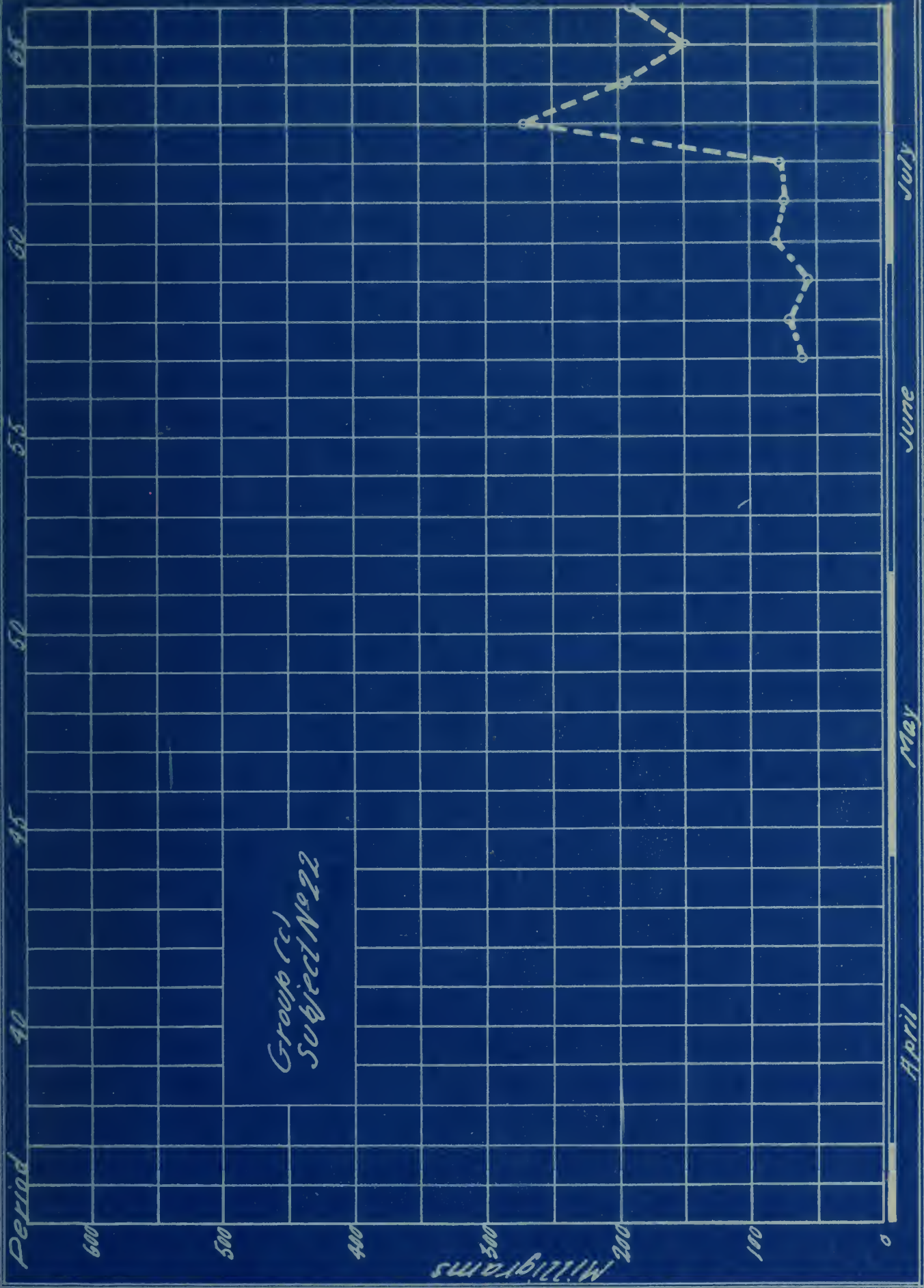


7

Urinary Nitrates per Man per Day, Group(C), Subject(22).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6123	6 Nov.29-D.2	949	93.7	none
6174	8 Dec. 7-10	847	96.3	"
6498	21 Jan.28-31	847	88.8	"
....	Average	881	92.9	"
....	Minimum	847	88.8	"
....	Maximum	949	96.3	"
8357	57 June20-23	660	62.5	none
8374	58 " 24-27	763	70.2	"
....	Average	711	66.3	none
....	Minimum	660	62.5	"
....	Maximum	763	70.2	"
8414	59 June28-Jy.1	731	56.0	none
8429	60 July 2-5	629	82.5	"
8462	61 " 6-9	696	75.3	"
8485	62 " 10-13	597	79.5	"
8490	63 " 14-17	644	272.1	"
8534	64 " 18-21	793	197.6	"
8545	65 " 22-25	684	149.0	"
8572	66 " 26-29	573	191.8	"
....	Average	668	138.0	none
....	Minimum	597	56.0	"
....	Maximum	793	272.1	"

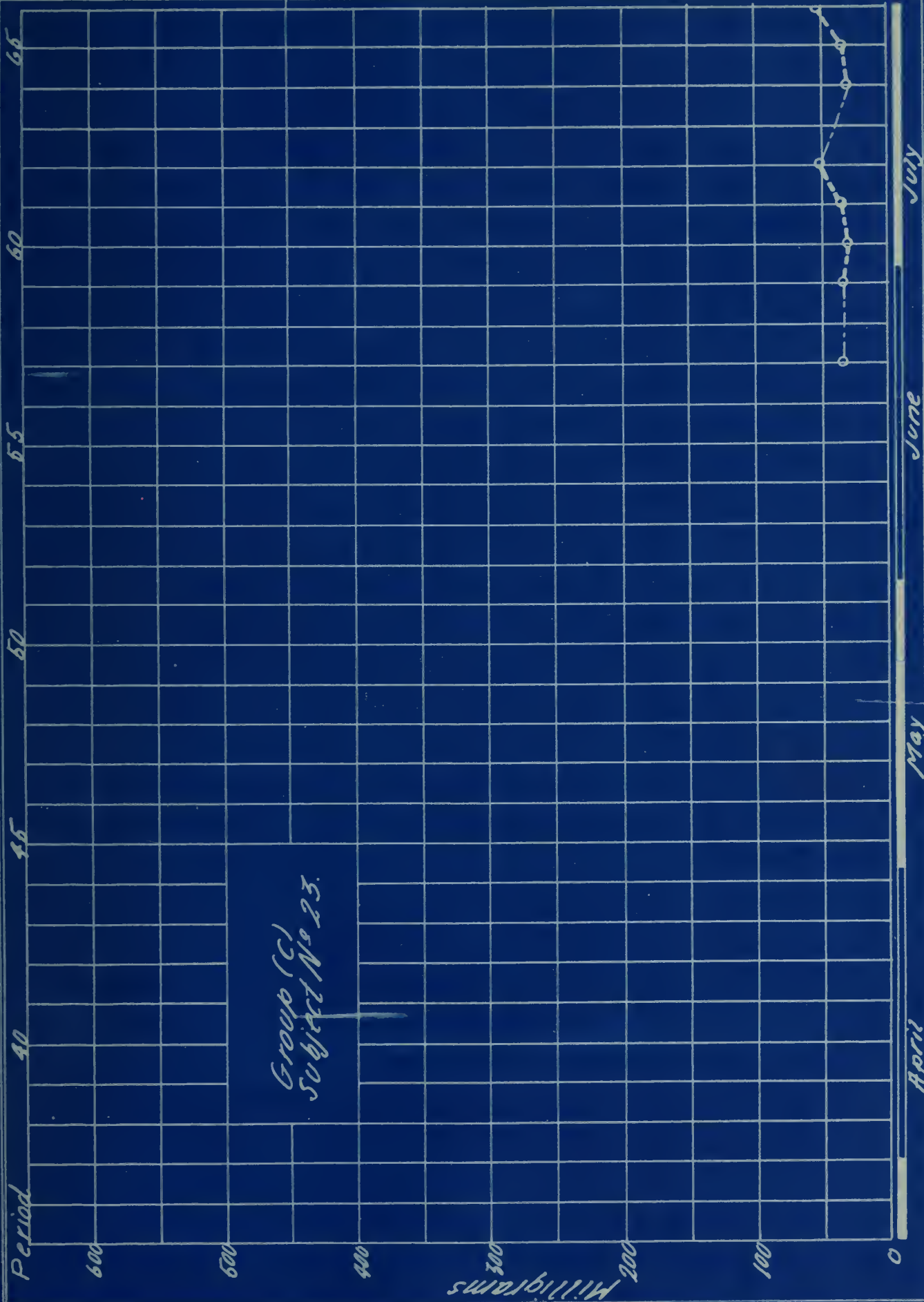
Group (c)
Subject No 22

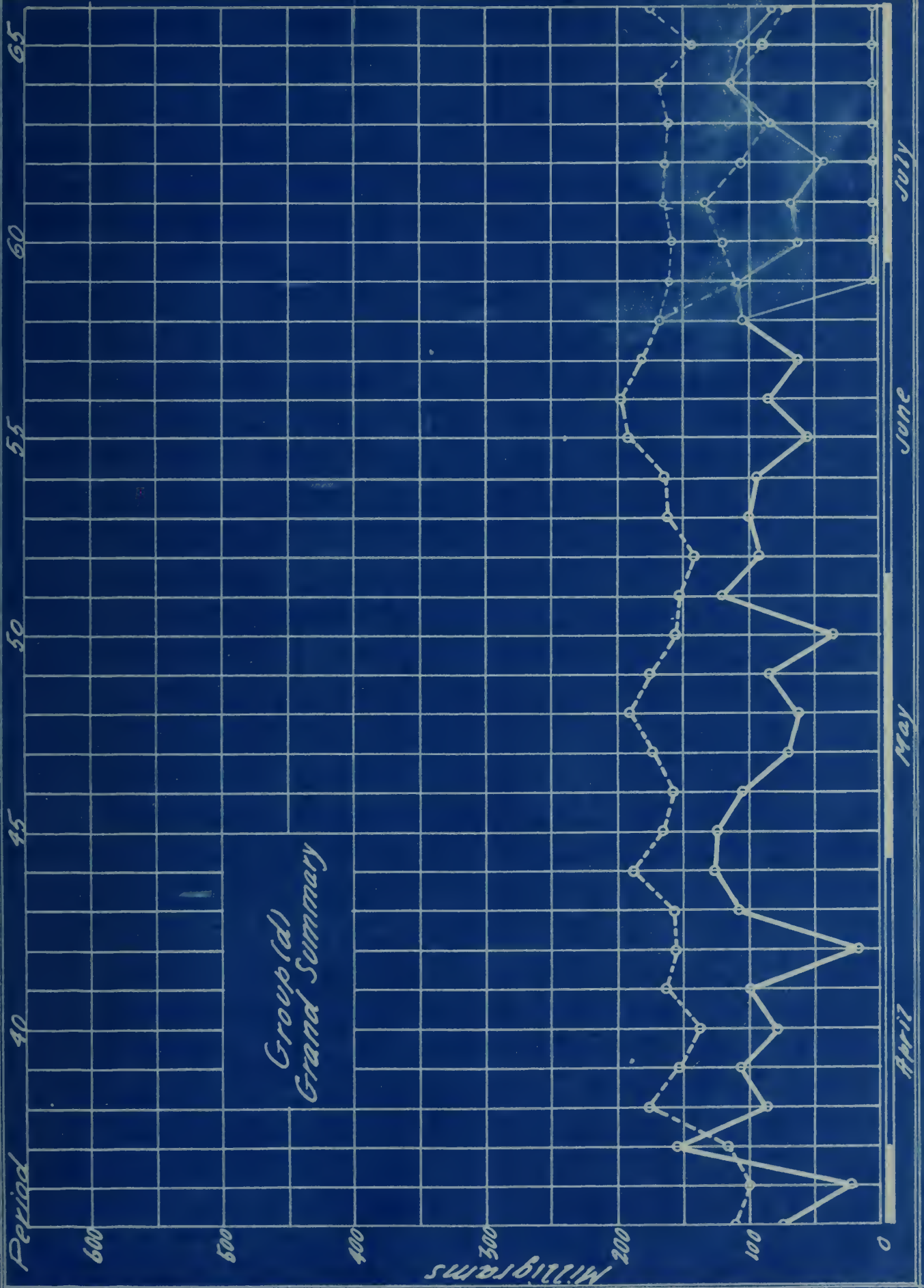


7

Urinary Nitrates per Man per Day, Group(C), Subject(23).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6735	31 Mar.8-11	1239	34.2	none
....	Average	....	....	....
....	Minimum	....	....	....
....	Maximum	....	....	....
8359	57 June 20-23	838	35.2	none
....	Average	....	....	....
....	Minimum	....	....	....
....	Maximum	....	....	....
8413	59 June28-Jy.1	896	35.1	none
8418	60 July 2-5	972	31.6	"
8442	61 " 6-9	838	37.1	"
8475	62 " 10-13	693	50.7	"
8519	64 " 18-21	1034	31.6	"
8553	65 " 22-25	902	36.2	"
8567	66 " 26-29	809	53.7	"
....	Average	874	39.4	none
....	Minimum	693	31.6	"
....	Maximum	1034	53.7	"





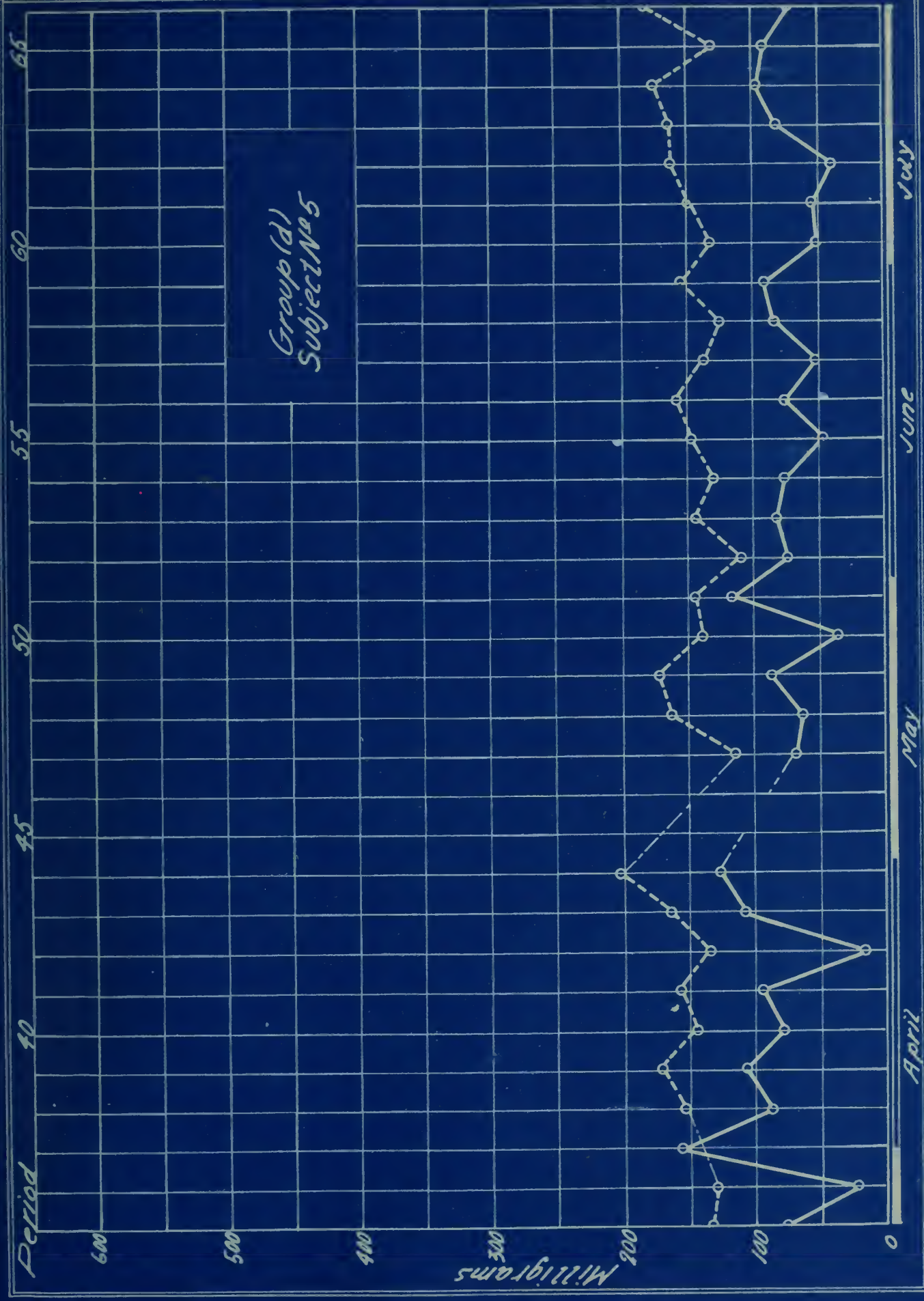
Ingested Potassium Nitrate per Man per Day, Group(D), Subject(5).

Lab. No.	Period-Date	Meat Consumed grams	Percentage of KNO ₃	Weight of Ingested KNO ₃ per 96 hours m-gms.	per 24 hours m-gms.
5369	35 Mar. 24-27	753.5	0.0413	311.2	77.8
5380	36 " 28-31	735.4	0.0125	91.9	23.0
5396	37 Apr. 1-4	730.3	0.0856	625.1	156.3
5409	38 " 5-8	739.2	0.0470	347.4	86.8
5423	39 " 9-12	739.7	0.0583	431.2	107.8
5437	40 " 13-16	744.6	0.0427	317.9	79.5
5450	41 " 17-20	741.9	0.0515	382.1	95.5
5463	42 " 21-24	745.0	0.0098	73.0	18.2
5473	43 " 25-28	739.8	0.0588	434.7	108.7
5489	44 " 29-m.2	748.5	0.0384	303.0	127.1
5502	45 May 3-6	.....	0.0683	.....	.....
5515	46 " 7-10	.....	0.0573	.....	.....
5528	47 " 11-14	733.8	0.0381	279.6	69.0
5541	48 " 15-18	740.0	0.0346	256.0	64.0
5554	49 " 19-22	742.5	0.0470	349.0	87.2
5567	50 " 23-26	726.0	0.0210	152.5	38.1
5580	51 " 27-30	723.1	0.0654	472.9	118.2
5593	52 " 31-J.3	538.2	0.0560	295.8	73.9
5606	53 June 4-7	544.3	0.0599	326.0	81.5
5619	54 " 8-11	546.7	0.0575	314.3	78.6
5632	55 " 12-15	542.2	0.0350	189.3	47.4
5645	56 " 16-19	557.1	0.0507	304.7	76.2
5658	57 " 20-23	547.4	0.0383	209.6	52.4
5671	58 " 24-27	536.8	0.0627	336.6	84.1
....	35-58 Average	.....	**0.0486	**318.6	**79.6
....	" " Minimum	.....	*0.0098	* 73.0	*18.2
....	" " Maximum	.....	***0.0856	***625.1	***156.3
5691	59 June 28-Jy.1	541.0	0.0684	370.0	92.5
5697	60 July 2-5	545.0	0.0376	204.9	51.2
5710	61 " 6-9	547.5	0.0402	220.1	55.0
5723	62 " 10-13	555.1	0.0290	161.0	40.2
5736	63 " 14-17	556.8	0.0594	330.7	82.7
5749	64 " 18-21	551.4	0.0705	388.7	97.2
5762	65 " 22-25	555.1	0.0665	369.1	92.3
5775	66 " 26-29	537.0	0.0538	288.9	72.2
....	59-66 Average	.....	**0.0532	**291.7	**73.9
....	" " Minimum	.....	*0.0290	*161.0	*40.2
....	" " Maximum	.....	***0.0705	***388.7	***97.2

NOTE:- The average of several analysis of Urbana-Champaign drinking water shows no nitrites and a value of one milligram of potassium nitrate per liter.

Urinary Nitrates per Man per Day, Group(D), Subject(5).

Lab. No.	Period-Date		Volume of	Potassium	Ingested KNO ₃
			Urine 24 hrs.	Nitrate 24 hrs.	per 24 hours
			c.c.	m-grams	m-grams
6435	19	Jan. 20-23	1274	71.8	none
6476	20	" 24-27	1255	76.3	"
6485	21	" 28-31	1319	85.8	"
6724	31	Mar. 8-11	1222	73.7	"
....	Average		1267	76.9	"
....	Minimum		1222	71.8	"
....	Maximum		1319	85.8	"
6826	35	Mar. 24-27	1018	134.6	77.8
6849	36	" 28-31	1185	130.6	23.0
6865	37	Apr. 1-4	1265	.....	156.3
6892	38	" 5-8	1381	153.0	86.8
6927	39	" 9-12	1186	172.3	107.8
6948	40	" 13-16	1247	145.3	79.5
6973	41	" 17-20	873	158.6	95.5
6996	42	" 21-24	1128	134.2	18.2
8024	43	" 25-28	1446	164.0	108.7
8037	44	" 29-M.2	1576	202.4	127.1
8115	47	May 11-14	937	114.9	69.0
8139	48	" 15-18	917	163.5	64.0
8166	49	" 19-22	1162	175.2	87.2
8181	50	" 23-26	872	140.4	38.1
8219	51	" 27-30	871	145.6	118.2
8229	52	" 31-J.3	1215	110.3	73.9
8265	53	June 4-7	794	144.2	81.5
8275	54	" 8-11	1096	131.1	78.6
8315	55	" 12-15	1188	147.3	47.4
8341	56	" 16-19	1014	159.4	76.2
8347	57	" 20-23	633	137.5	52.4
8389	58	" 24-27	859	126.9	84.1
....	Average		1085	140.5	79.6
....	Minimum		633	110.3	18.2
....	Maximum		1576	202.4	156.3
8398	59	June 28-JY.1	843	154.2	92.5
8457	60	July 2-5	892	132.4	51.2
8460	61	" 6-9	936	149.3	55.0
8465	62	" 10-13	617	162.8	40.2
8496	63	" 14-17	838	164.6	82.7
8528	64	" 18-21	1040	175.4	97.2
8551	65	" 22-25	1093	131.6	92.3
8569	66	" 26-29	705	181.3	72.2
....	Average		870	156.4	73.9
....	Minimum		617	131.6	40.2
....	Maximum		1093	181.3	97.2



Ingested Potassium Nitrate per Man per Day, Group(D), Subject(10).

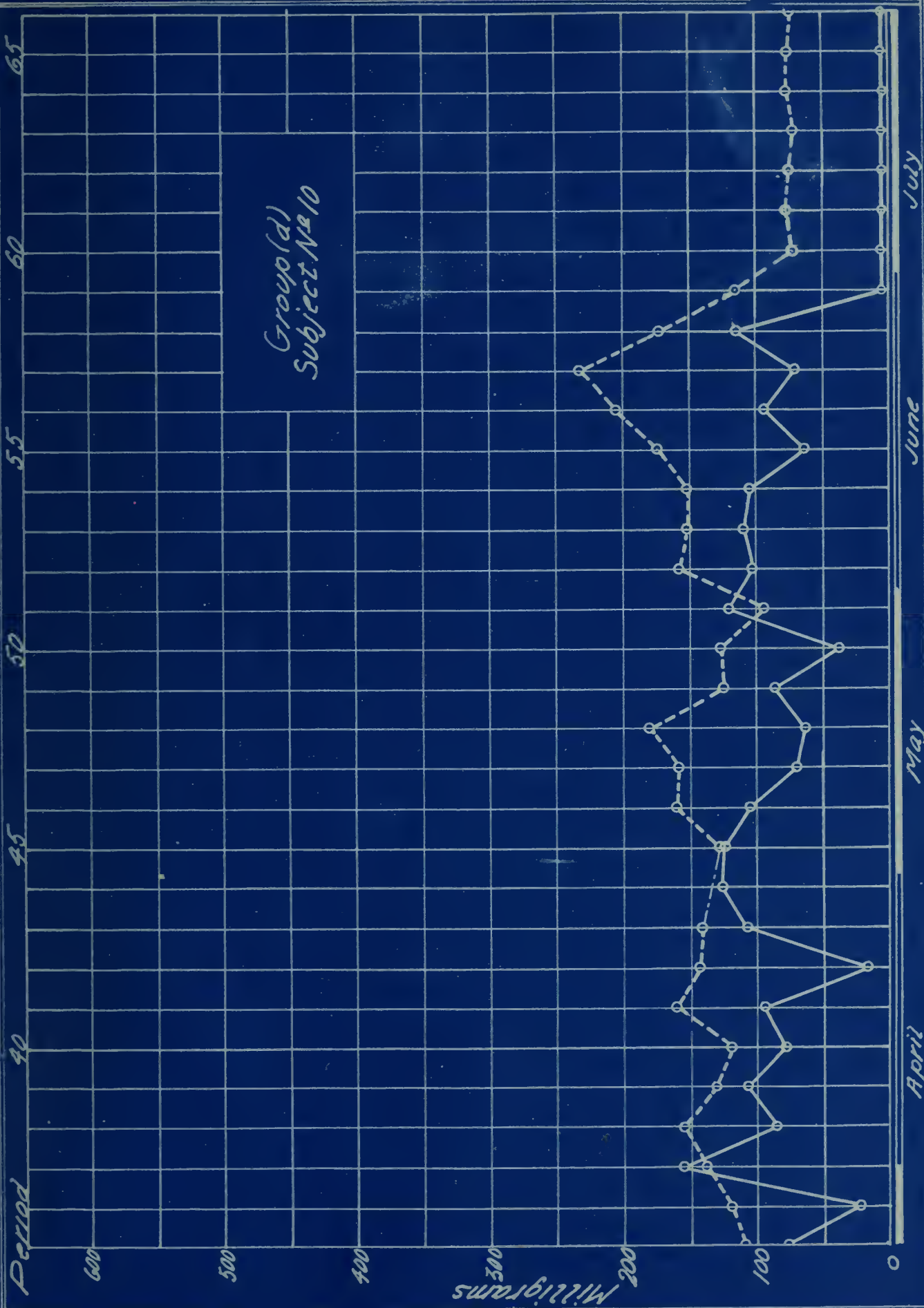
Lab. No.	Period-Date	Meat Consumed grams	Percentage of KNO ₃	Weight of Ingested KNO ₃ per 96 hours per 24 hours m-gms. m-gms.	
5369	35 Mar.24-27	753.5	0.0413	311.2	77.8
5380	36 " 28-31	735.4	0.0125	91.9	23.0
5396	37 Apr. 1-4	730.3	0.0856	625.1	156.3
5409	38 " 5-8	739.2	0.0470	347.4	86.8
5423	39 " 9-12	739.7	0.0583	431.2	107.8
5437	40 " 13-16	744.6	0.0427	317.9	79.5
5450	41 " 17-20	741.9	0.0515	382.1	95.5
5463	42 " 21-24	745.0	0.0098	73.0	18.2
5476	43 " 25-28	739.3	0.0588	434.7	108.7
5489	44 " 29-M.2	743.5	0.0684	508.5	127.1
5502	45 May 3-6	736.1	0.0683	502.8	125.7
5515	46 " 7-10	742.6	0.0573	425.5	106.4
5528	47 " 11-14	743.6	0.0381	283.3	70.8
5541	48 " 15-18	746.0	0.0346	256.0	64.0
5554	49 " 19-22	742.5	0.0470	349.0	87.2
5567	50 " 23-26	743.1	0.0210	156.0	39.0
5580	51 " 27-30	745.8	0.0654	487.7	121.9
5593	52 " 31-J.3	740.9	0.0560	414.9	103.7
5606	53 June 4-7	739.7	0.0599	443.1	110.8
5619	54 " 8-11	742.6	0.0575	427.0	106.7
5632	55 " 12-15	733.9	0.0350	256.9	64.2
5645	56 " 16-19	742.8	0.0507	376.6	94.1
5658	57 " 20-23	744.1	0.0383	285.0	71.2
5671	58 " 24-27	742.8	0.0627	465.7	116.4
....	35-58 Average	.....	**0.0486	**360.5	** 90.1
....	" " Minimum	.....	*0.0098	* 73.0	* 18.2
....	" " Maximum	.....	***0.0856	***625.1	***156.3
5691	59 June28-Jy.1	739.6	none	none	none
5697	60 July 2-5	740.4	"	"	"
5710	61 " 6-9	743.4	"	"	"
5723	62 " 10-13	740.1	none	none	none
5736	63 " 14-17	742.4	"	"	"
5749	64 " 18-21	735.2	"	"	"
5762	65 " 22-25	740.2	"	"	"
5775	66 " 26-29	743.3	"	"	"

NOTE:- The average of several analysis of Urbana-Champaign drinking water shows no nitrites and a value of one milligram of potassium nitrate per liter.

Urinary Nitrates per Man per Day, Group(D), Subject(10)

Lab. No.	Period-Date	Volume Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6059	3 Nov.17-20	1368	176.2	none
6142	6 " 29-D.2	1705	89.9	"
6178	8 Dec. 7-10	1265	59.9	"
6454	19 Jan.20-23	1333	65.5	"
6457	20 " 24-27	1495	30.0	"
6500	21 " 28-31	1445	52.2	"
6742	31 Mar. 8-11	1296	71.6	"
....	Average	1415	77.9	"
....	Minimum	1265	30.0	:
....	Maximum	1705	176.2	"
6818	35 Mar.24-27	990	110.5	77.8
6854	36 " 28-31	1401	120.5	23.0
6877	37 Apr. 1-4	1236	139.6	156.3
6910	38 " 5-8	1250	154.7	86.8
6922	39 " 9-12	1146	131.8	107.8
6950	40 " 13-16	901	120.8	79.5
6971	41 " 17-20	963	161.1	95.5
6998	42 " 21-24	1050	144.1	18.2
8019	43 " 25-28	1328	143.1	108.7
8048	44 " 29-M.2	1235	.....	127.1
8057	45 May 3-6	1412	128.7	125.7
8104	46 " 7-10	1326	161.5	106.4
8112	47 " 11-14	926	160.7	70.8
8135	48 " 15-18	929	181.1	64.0
8175	49 " 19-22	955	126.7	87.2
8191	50 " 23-26	893	128.4	39.0
8202	51 " 27-30	873	96.7	121.9
8246	52 " 31-J.3	1137	159.7	103.7
8251	53 June 4-7	880	152.7	110.8
8288	54 " 8-11	903	152.4	106.7
8304	55 " 12-15	883	175.4	64.2
8328	56 " 16-19	883	206.3	94.1
8360	57 " 20-23	744	233.0	71.2
8382	58 " 24-27	779	174.2	116.4
....	Average	1043	144.4	90.1
....	Minimum	774	96.7	18.2
....	Maximum	1412	233.0	156.3
8395	59 June28-Jy.1	878	117.8	none
8427	60 July 2-5	898	73.8	"
8454	61 " 6-9	749	79.4	"
8469	62 " 10-13	700	77.3	"
8506	63 " 14-17	762	73.3	"
8518	64 " 18-21	953	78.1	"
8554	65 " 22-25	850	76.5	"
8566	66 " 26-29	871	74.5	"
....	Average	833	81.8	"
....	Minimum	700	73.3	"
....	Maximum	953	117.8	"

Group (d)
Subject No 10



Ingested Potassium Nitrate per Man per Day, Group(D), Subject(11).

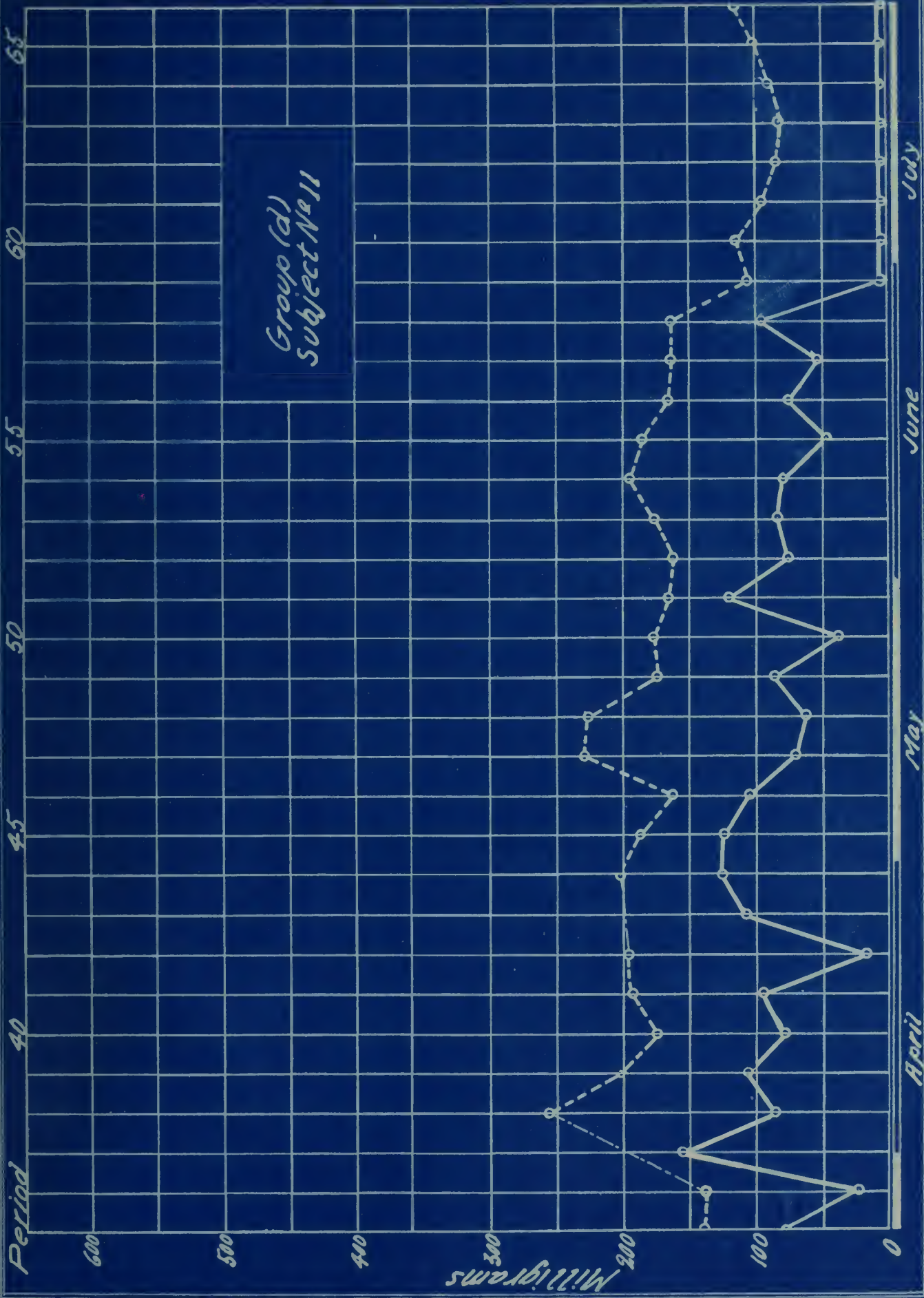
Lab. No.	Period-Date	Meat Consumed grams	Percentage of KNO ₃	Weight of Ingested KNO ₃ per 96 hours per 24 hours m-gms. m-gms.	
5369	35 Mar.24-27	753.5	0.0413	311.2	77.8
5380	36 " 28-31	735.4	0.0125	91.9	23.0
5396	37 Apr. 1-4	730.3	0.0856	625.1	156.3
5409	38 " 5-8	739.2	0.0470	347.7	86.8
5423	39 " 9-12	739.7	0.0583	431.2	107.8
5437	40 " 13-16	744.6	0.0427	317.9	79.5
5450	41 " 17-20	741.9	0.0515	382.1	95.5
5463	42 " 21-24	745.0	0.0098	73.0	18.2
5476	43 " 25-28	739.3	0.0588	434.7	108.7
5489	44 " 29-M.2	743.5	0.0684	508.5	127.1
5502	45 May 3-6	736.1	0.0683	502.8	125.7
5515	46 " 7-10	742.6	0.0573	425.5	196.4
5528	47 " 11-14	743.6	0.0381	283.3	70.8
5541	48 " 15-18	749.0	0.0346	256.0	64.0
5554	49 " 19-22	742.5	0.0470	349.0	87.2
5567	50 " 23-26	743.1	0.0210	156.0	39.0
5580	51 " 27-30	745.8	0.0654	487.7	121.9
5593	52 " 31-J.3	555.7	0.0560	310.0	77.7
5606	53 June 4-7	554.8	0.0599	332.3	83.1
5619	54 " 8-11	556.9	0.0575	320.2	80.0
5632	55 " 12-15	550.4	0.0350	192.3	48.1
5645	56 " 16-19	557.1	0.0507	394.7	76.2
5658	57 " 20-23	558.8	0.0383	213.7	53.4
5671	58 " 24-27	557.1	0.0627	389.3	97.3
....	35-58 Average	.....	**0.0486	**335.2	** 83.8
....	" " Minimum	.....	*0.0098	73.0	* 73.0
....	" " Maximum	.....	***0.0856	***625.1	***156.3
5691	59 June 28-Jy.1	555.4	none	none	none
5697	60 July 2-5	555.3	"	"	"
5710	61 " 6-9	557.5	"	"	"
5723	63 " 10-13	555.1	"	"	"
5736	63 " 14-17	556.8	"	"	"
5749	64 " 18-21	551.4	"	"	"
5762	65 " 22-25	.....	.....	.....	.....
5775	66 " 26-29	.....	.....	.....	.....

NOTE:-The average of several analysis of Urbana-Champaign drinking water shows no nitrites and a value of one milligram of potassium nitrate per liter.

Urinary Nitrates per Man per Day, Group(D), Subject(11).

Lab. No.	Period-Date	Volume Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6097	4 Nov.21-24	1350	128.8	none
6140	6 " 29-D.2	1425	190.0	"
6148	7 Dec. 3-6	1271	186.9	"
6182	8 " 7-10	1593	110.7	"
6433	19 Jan.20-23	1501	95.6	"
6478	20 " 24-27	1423	73.5	"
6481	21 " 28-31	1348	83.3	"
6731	31 Mar. 8-11	1140	145.9	"
....	Average	1381	126.8	"
....	Maximum	1593	190.0	"
....	Minimum	1140	73.5	"
6838	35 Mar.24-27	1005	139.9	77.8
6860	36 " 28-31	1408	139.2	23.0
6890	38 Apr. 5-8	1434	253.6	86.8
6929	39 " 9-12	954	201.1	107.8
6943	40 " 13-16	1247	175.1	79.5
6978	41 " 17-20	1256	193.0	95.5
6991	42 " 21-24	1349	197.1	18.2
8042	44 " 29-M.2	1276	203.1	127.1
8069	45 May. 3-6	1501	189.1	125.7
8084	46 " 7-10	1311	164.4	196.4
8119	47 " 11-14	1377	230.8	70.8
8148	48 " 15-18	1157	227.1	64.0
8158	49 " 19-22	1255	175.3	87.2
8196	50 " 23-26	974	177.4	39.0
8211	51 " 27-30	1159	167.4	121.9
8237	52 " 31-J.3	1537	164.8	77.7
8259	53 June 4-7	914	177.3	83.1
8285	54 " 8-11	936	196.8	80.0
8307	55 " 12-15	906	185.8	48.1
8337	56 " 16-19	1024	167.1	76.2
8352	57 " 20-23	716	164.8	53.4
8385	58 " 24-27	1006	164.3	97.3
....	Average	1155	180.9	83.8
....	Minimum	716	139.2	73.0
....	Maximum	1537	253.6	156.3
8401	59 June28-Jy.1	874	105.9	none
8424	60 July 2-5	776	114.9	"
8450	61 " 6-9	864	96.2	"
8471	62 " 10-13	589	86.2	"
8510	63 " 14-17	868	81.6	"
8514	64 " 18-21	1047	90.4	"
8556	65 " 22-25	832	100.5	"
8564	66 " 26-29	632	115.3	"
....	Average	801	98.9	"
....	Minimum	589	81.6	"
....	Maximum	1047	115.3	"

Group (d)
Subject No 11



Ingested Potassium Nitrate per Man per Day, Group(D), Subject(13).

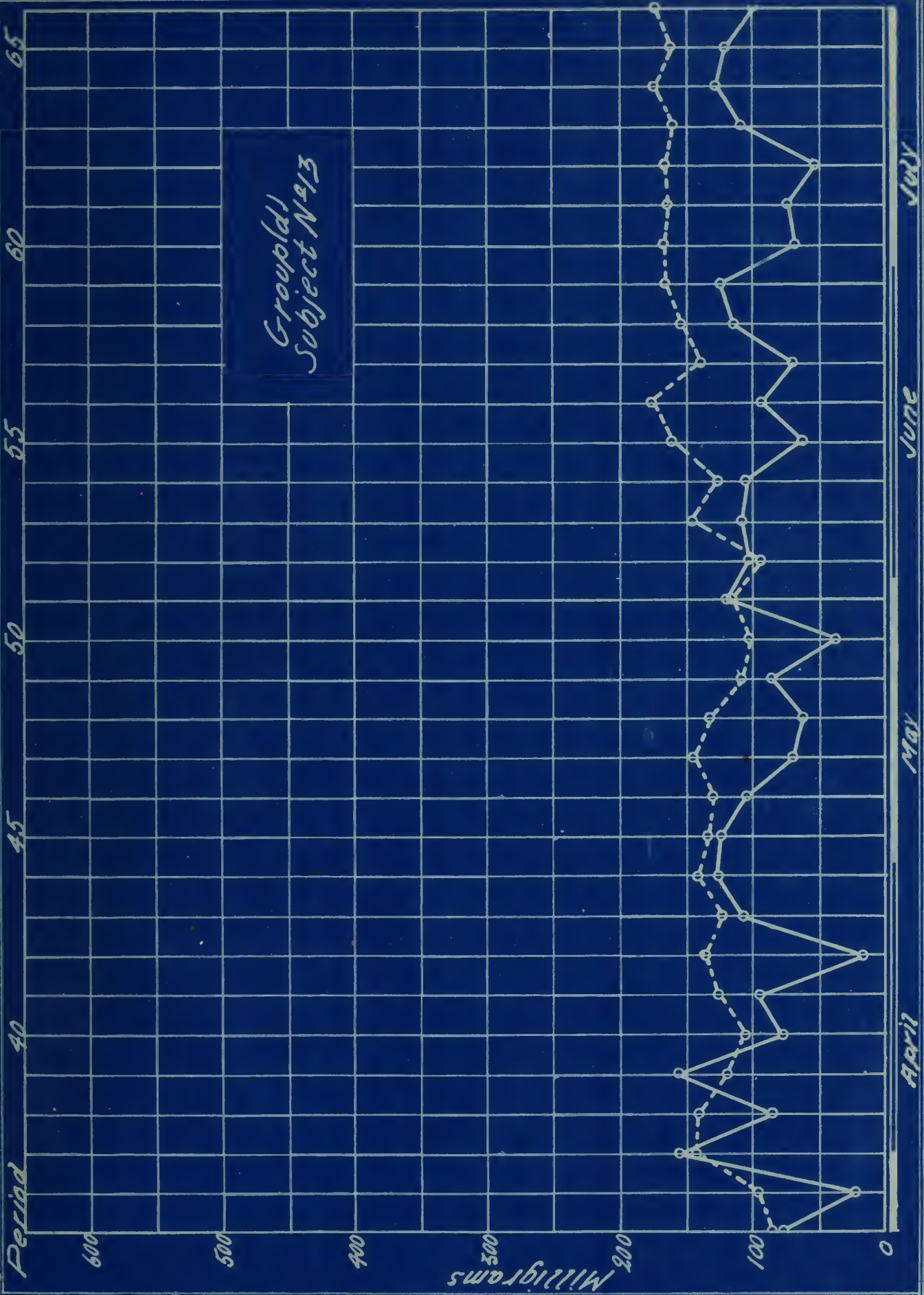
Lab. No.	Period-Date	Meat Consumed grams	Percentage of KNO ₃	Weight of Igested KNO ₃ per 96 hours per 24 hours	
				m-gms.	m-gms.
5396	35 Mar. 24-27	753.5	0.0413	311.2	77.8
5380	36 " 28-31	735.4	0.0125	91.9	23.0
5396	37 Apr. 1-4	730.3	0.0856	625.1	156.3
5409	38 " 5-8	739.2	0.0470	347.4	86.8
5423	39 " 9-12	739.7	0.0583	431.2	107.8
5439	40 " 13-16	744.6	0.0427	317.9	79.5
5450	41 " 17-20	741.9	0.0515	382.1	95.5
5463	42 " 21-24	743.8	*0.0098	*72.9	*18.2
5476	43 " 25-28	739.3	0.0588	434.7	108.7
5489	44 " 29-M.2	743.5	0.0684	508.5	127.1
5502	45 May 3-6	736.1	0.0683	502.8	125.7
5515	46 " 7-10	742.6	0.0573	425.5	106.4
5528	47 " 11-14	743.6	0.0381	283.3	70.8
5541	48 " 15-18	740.0	0.0346	256.0	64.0
5554	49 " 19-22	742.5	0.0470	349.0	87.2
5567	50 " 23-26	743.1	0.0210	156.0	39.0
5580	51 " 27-30	745.8	0.0654	487.7	121.9
5593	52 " 31-J.3	740.0	0.0560	414.5	103.6
5606	53 June 4-7	739.7	0.0599	443.1	110.8
5619	54 " 8-11	742.6	0.0575	427.0	106.7
5632	55 " 12-15	733.9	0.0350	256.9	64.2
5645	56 " 16-19	742.8	0.0507	376.6	94.1
5658	57 " 20-23	744.1	0.0383	285.0	71.2
5671	58 " 24-27	742.8	0.0627	465.7	116.4
....	35-58 Average	....	**0.0486	**360.5	** 90.1
....	" " Minimum	....	*0.0098	* 72.9	* 18.2
....	" " Maximum	....	***0.0856	***625.1	***156.3
5691	59 June 28-Jy.1	740.6	0.0684	506.6	126.6
5697	60 July 2-5	740.4	0.0376	278.4	69.6
5710	61 " 6-9	743.4	0.0402	298.8	74.7
5723	62 " 10-13	740.1	0.0290	214.6	53.6
5736	63 " 14-17	742.4	0.0594	441.0	110.2
5749	64 " 18-21	735.2	0.0705	518.3	129.6
5762	65 " 22-25	740.2	0.0665	492.2	123.0
5775	66 " 26-29	743.3	0.0538	399.9	100.0
....	59-66 Average	....	**0.0532	**393.6	** 98.4
....	" " Minimum	....	*0.0290	*214.6	* 53.6
....	" " Maximum	....	***0.0705	***518.3	***129.6

NOTE:- The average of several analysis of Urbana-Champaign drinking water shows no nitriter and a value of one milligram of potassium nitrate per liter.

Urinary Nitrates per Man per Day, Group(D), Subject(13).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6732	31 Mar. 8-11	1649	34.0	none
....	Average	....	....	....
....	Minimum	....	....	....
....	Maximum	....	....	....
6839	35 Mar. 24-27	1214	86.7	77.8
6855	36 " 28-31	1544	96.8	23.0
6871	37 Apr. 1-4	1378	143.9	156.3
6904	38 " 5-8	1521	141.1	86.8
6916	39 " 9-12	1409	120.4	107.8
6959	40 " 13-16	1316	106.7	79.5
6962	41 " 17-20	1270	127.8	95.5
8007	42 " 21-24	1241	138.7	18.2
8013	43 " 25-28	1511	124.9	108.7
8053	44 " 29-M.2	1515	142.1	127.1
8066	45 May 3-6	1716	135.8	125.7
8087	46 " 7-10	1418	131.2	106.4
8109	47 " 11-14	1303	147.6	70.8
8140	48 " 15-18	1404	133.9	64.0
8164	49 " 19-22	1379	110.9	87.2
8183	50 " 23-26	1123	103.6	39.0
8216	51 " 27-30	1076	128.0	121.9
8230	52 " 31-J.3	1668	96.4	103.6
3268	53 June 4-7	1050	147.1	110.8
3280	54 " 8-11	1235	128.2	106.7
3312	55 " 12-15	1123	162.6	64.2
3324	56 " 16-19	931	178.4	94.1
8364	57 " 20-23	714	140.9	71.2
8391	58 " 24-27	790	154.1	116.3
....	Average	1285	125.5	90.1
....	Minimum	714	86.7	18.2
....	Maximum	1716	178.4	156.3
8394	59 June 28-Jy.1	1018	168.6	126.6
3439	60 July 2-5	1066	169.1	69.6
8447	61 " 6-9	812	165.6	74.7
8479	62 " 10-13	759	169.5	53.6
8498	63 " 14-17	765	162.4	110.2
8526	64 " 18-21	1131	175.3	129.6
8538	65 " 22-25	860	164.1	123.0
8583	66 " 26-29	983	177.1	100.0
....	Average	924	169.0	98.4
....	Minimum	765	162.4	53.6
....	Maximum	1131	177.1	129.6

Group(d)
Subject N^o 2/3



Ingested Potassium Nitrate per Man per Day, Group(D), Subject(20).

Lab. No.	Period-Date	Meat Consumed grams	Percentage of KNO ₃	Weight of Ingested KNO ₃	
				per 96 hours m-gms.	per 24 hours m-gms.
5396	35 Mar. 24-27	813.5	0.0413	336.0	84.0
5380	36 " 28-31	793.9	0.0125	99.2	24.8
5396	37 Apr. 1-4	787.8	0.0856	674.4	168.6
5409	38 " 5-8	798.7	0.0470	375.4	93.8
5423	39 " 9-12	798.7	0.0583.	465.6	116.4

No further data.

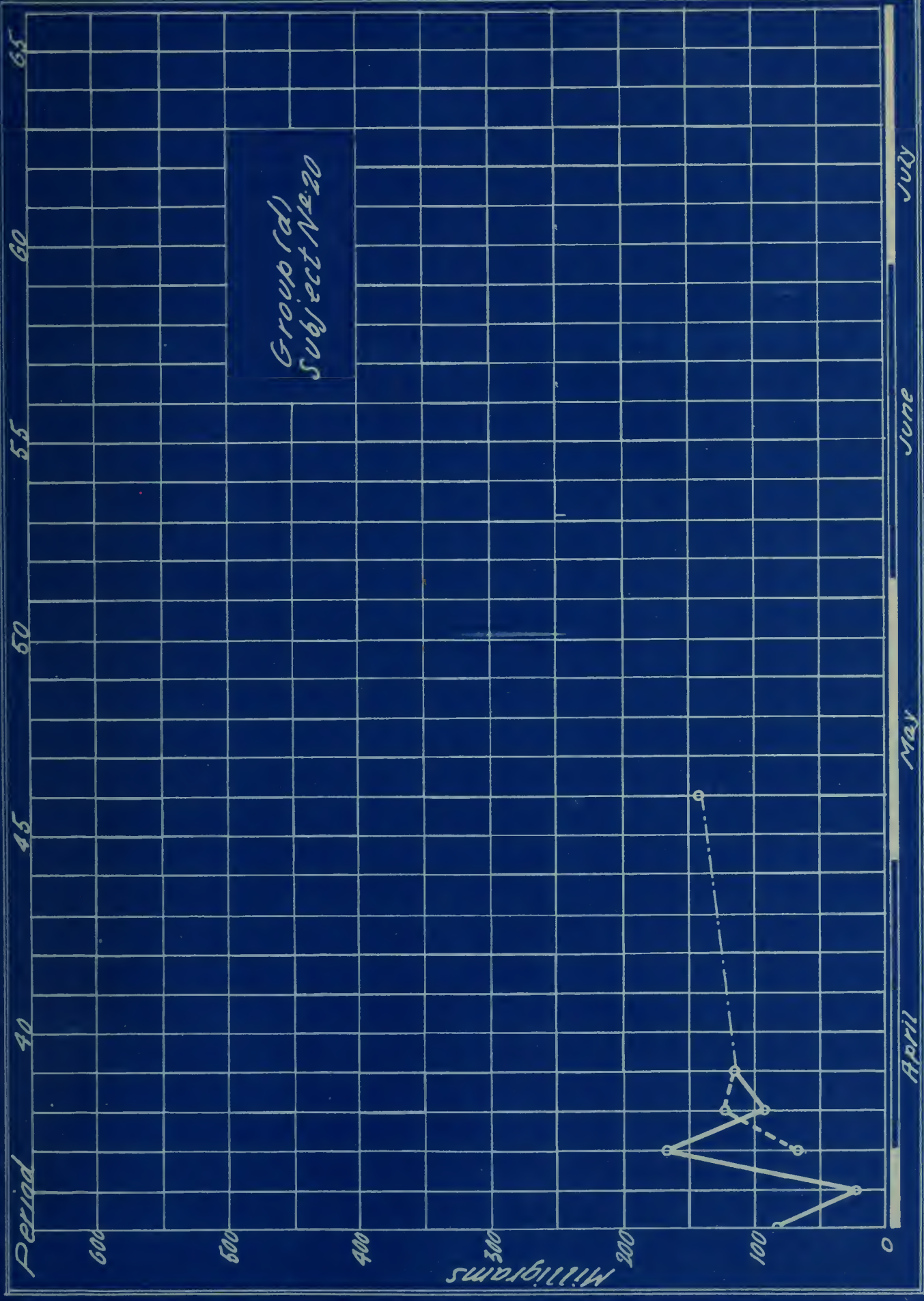
NOTE:- The average of several analysis of Urbana-Champaign drinking water shows no nitrites and a value of one milligram of potassium nitrate per liter.

Urinary Nitrates per Man per Day, Group(D), Subject(20).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrate 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6741	31 Mar. 8-11	1574	40.9	none
....	Average	....	....	....
....	Minimum	....	....	....
....	Maximum	....	....	....
6886	37 Apr. 1-4	1071	68.1	168.6
6893	38 " 5-8	1081	123.4	93.8
6926	39 " 9-12	1039	115.4	118.4
8098	46 May 7-10	1294	142.6	....
....	Average	1121	112.4	126.3
....	Minimum	1039	68.1	93.8
....	Maximum	1294	142.6	168.6

No further data.

Group (d)
Subj. 2221 No. 20



Ingested Potassium Nitrate per Man per Day, Group(D), Subject(24).

Lab. No.	Period-Date	Meat Consumed grams	Percentage of KNO ₃	Weight of Ingested KNO ₃ per 96 hours, per 24 hours M.grams M.grams	
5369	35 Mar.24-27	753.5	0.0413	311.2	77.8
5380	36 " 28-31	735.4	0.0125	91.9	23.0
5396	37 Apr. 1-4	730.3	0.0856	625.1	156.3
5409	38 " 5-8	739.2	0.0470	347.4	86.8
5423	39 " 9-12	739.7	0.0583	431.2	107.8
5437	40 " 13-16	744.6	0.0427	317.9	79.5
5450	41 " 17-20	741.9	0.0515	382.1	95.5
5463	42 " 21-24	745.0	0.0098	73.0	18.2
5476	43 " 25-28	739.3	0.0538	434.7	108.7
5489	44 " 29-M.2	743.5	0.0684	508.5	127.1
5502	45 May 3-6	736.1	0.0683	502.8	125.7
5515	46 " 7-10	742.6	0.0573	425.5	106.4
5528	47 " 11-14	743.6	0.0381	283.3	70.8
5541	48 " 15-18	740.0	0.0346	256.0	64.0
5554	49 " 19-22	742.5	0.0470	349.0	87.2
5567	50 " 23-26	743.1	0.0210	156.0	39.0
5580	51 " 27-30	745.8	0.0654	487.7	121.9
5593	52 " 31-J.3	740.9	0.0560	414.9	103.7
5606	53 June 4-7	739.7	0.0599	443.1	110.8
5619	54 " 8-11	742.6	0.0575	427.0	106.7
5632	55 " 12-15	733.1	0.0350	256.9	64.2
5645	56 " 16-19	742.8	0.0507	376.6	94.1
5658	57 " 20-23	744.1	0.0383	285.0	71.2
5671	58 " 24-27	742.8	0.0627	465.7	116.4
....	35-58 Average	.....	**0.0486	**360.5	**90.1
....	" " Minimum	.....	*0.0098	* 73.0	*18.2
....	" " Maximun	.....	*0.0856	*625.1	*156.3
5691	59 June28-Jyl	740.6	0.0000	00000	00000
5697	60 July 2-5	738.6	0.0000	00000	00000
5710	61 " 6-9	743.4	0.0000	00000	000000
5723	62 " 10-13	740.1	0.0000	00000	00000
5736	63 " 14-17	742.4	0.0000	00000	00000
5749	64 " 18-21	735.2	0.0000	00000	00000
5762	65 " 22-25	740.2	0.0000	00000	00000
5775	66 " 26-29	743.3	0.0000	000000	00000
....	59-66 Average)				
....	" " Minimum) =		0.0000	00000	00000
....	" " Maximum)				

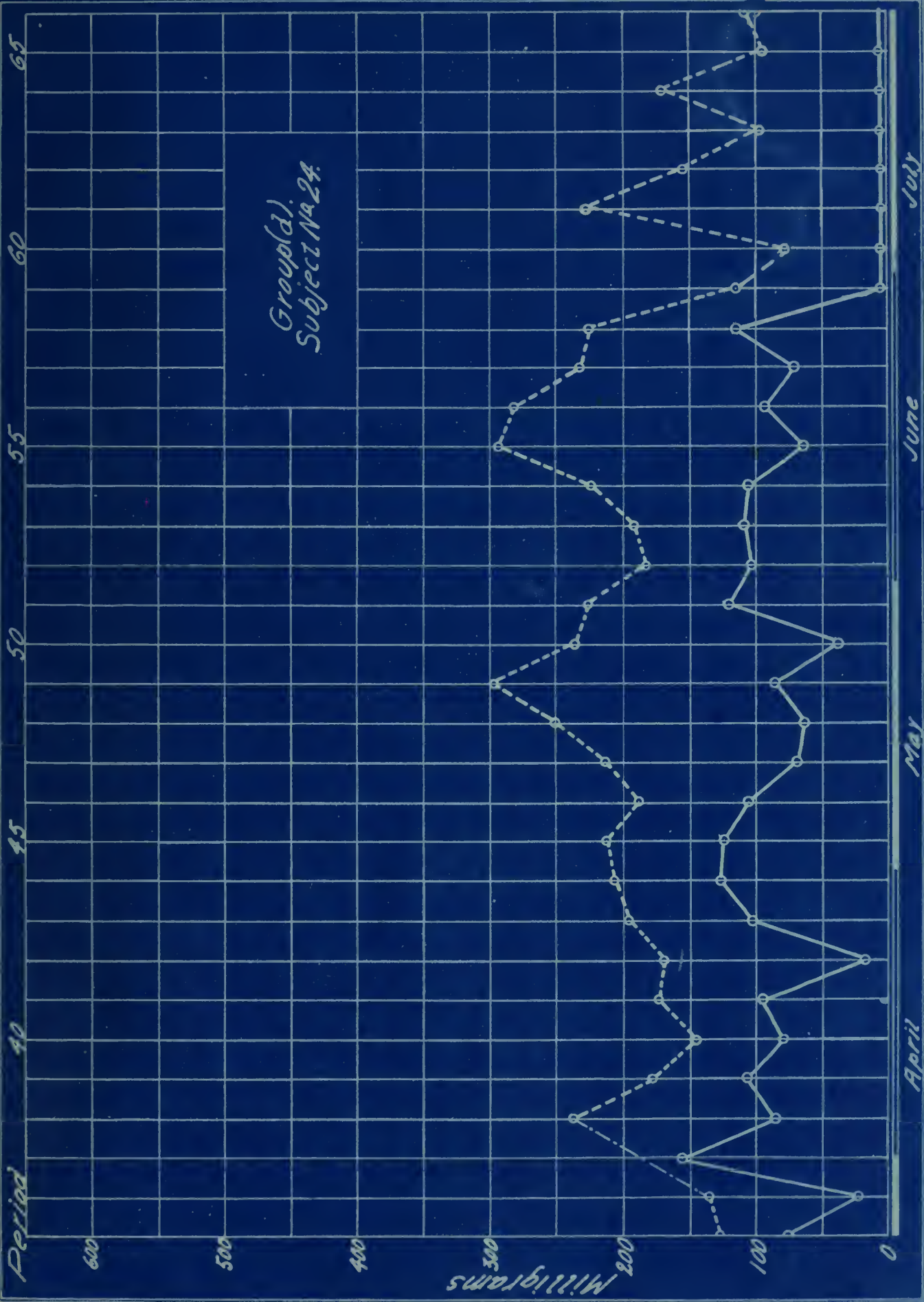
NOTE:- The average of several analysis of Urbana-Champaign drinking water shows no nitrites and a value of one milligram of potassium nitrate per liter.

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Urinary Nitrates per Man per Day, Group(D), Subject(24).

Lab. No.	Period-Date	Volume of Urine 24 hrs. c.c.	Potassium Nitrates 24 hrs. m-grams	Ingested KNO ₃ per 24 hours m-grams
6740	31 Mar. 8-11	1685	102.8	none
....	Average	....	.....	....
....	Minimum	....	.....	....
....	Maximum	....	.....	....
6819	35 Mar. 24-27	1319	127.4	77.8
6848	36 " 28-31	2193	134.0	23.0
6908	38 Apr. 5-8	1736	238.1	86.8
6924	39 " 9-12	1329	179.2	107.8
6951	40 " 13-16	1518	145.6	79.5
6970	41 " 17-20	1700	174.1	95.5
6999	42 " 21-24	1490	170.1	18.2
8018	43 " 25-28	1637	169.2	108.7
8050	44 " 29-M.2	1625	208.0	127.1
8060	45 May 3--6	1656	214.0	125.7
8101	46 " 7-10	1404	189.5	106.4
8107	47 " 11-14	1775	214.7	70.8
8136	48 " 15-18	1782	250.7	64.0
8173	49 " 19-22	1349	297.4	87.2
8187	50 " 23-26	1206	238.8	39.0
8208	51 " 27-30	1140	228.4	121.9
8242	52 " 31-J.3	1605	183.0	103.7
8254	53 June 4-7	1258	192.6	110.8
8293	54 " 8-11	1313	224.2	106.7
8301	55 " 12-15	1291	293.9	64.2
8334	56 " 16-19	1204	282.4	94.1
8355	57 " 20-23	886	234.0	71.2
8370	58 " 24-27	1005	227.0	116.4
....	Average	1456	210.6	90.1
....	Minimum	886	127.4	18.2
....	Maximum	2193	297.4	156.3
8406	59 June 28-Jy.1	1122	117.6	none
8433	60 July 2-5	1178	79.3	"
8457	61 " 6-9	949	229.4	"
8483	62 " 10-13	811	153.3	"
8491	63 " 14-17	1403	98.9	"
8533	64 " 18-21	1156	171.8	"
8546	65 " 22-27	1272	94.4	"
8573	66 " 26-29	1078	108.7	"
....	Average	1121	131.7	none
....	Minimum	811	79.3	"
....	Maximum	1403	229.4	"

Group(d).
Subject No 24.



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